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The Research Quarterly

of the

American Association for Health and Physical Education

VOL. VIII OCTOBER, 1937

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Health Knowledge of High School and College Students

By H. F. Kilander, Ph.D.

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HEALTH education is today recognized by leading educators as of vital importance in the education of youth. But health education has not established itself as yet in our schools in a way comparable with other subjects. This statement applies especially to the college and secondary school levels. There are many reasons for this situation. We shall consider only one, namely, the fact that there are so few accepted standards of achievement for various age levels in health education. The situation is very different in subjects like language, mathematics, and the sciences where the objectives are definite and observable.

The objectives of health education imply many problems which make measurement desirable and necessary. We would like to be able to measure and evaluate such factors as conduct, judgment, experience, habits, attitudes, and knowledge of facts as they pertain to health. But some questions of health are so subjective that it is difficult to obtain valid tests in regard to them. Of the factors mentioned, it is only health knowledge which can be tested with fair accuracy. And yet it is the health attitudes and habits which are, in themselves, of more importance than pure knowledge of facts. Health education is in this respect very much like character education.

However, it is generally agreed that knowledge is an essential part of the school program in health education, and we should not minimize this fact too much. Since it is impossible to form in school all the specific health habits needed by an individual, knowledge is essential in aiding the individual to make satisfactory responses to new situations. Knowledge is needed in furnishing rational motives for attitudes and habits. We may know why we should eat certain foods without this knowledge having any appreciable effect on our conduct, just as we may know certain rules of grammar and yet speak incorrectly. However, when knowledge stimulates self-analysis and serves as a motivation, then it is the type of knowledge desired in health education. It is this type of knowledge especially which we should seek to measure.

There are shortcomings to any type of testing in health education, whether it be of habits, attitudes, or knowledge. On the elementary

school level a good deal is being done with the determination of habits and attitudes. However, for levels above the elementary school we must assume that the best we can do for the present is to test the effectiveness of our teaching of facts, in the hope that we, as teachers, can furnish through these facts, combined with our method of instruction, the incentives which will lead to correct and desirable attitudes and habits.

With these points in mind the writer undertook an investigation of the health information of high school and college students. Specifically the purpose of this survey was (1) to determine the relative scores (norms) of high school and college classes; (2) to determine in which fields of health education students are best and least informed; (3) to determine what factors contribute to greater health knowledge or a lack of health knowledge; and (4) to offer certain suggestions based upon the findings of the investigation.

PROCEDURE

A preliminary survey was first made in the spring of 1936. A test consisting of one hundred multiple-choice questions was given to 2900 individuals. Included in this group were students in all four years of both high schools and colleges and adults of a wide variety of occupations and ages. The original plan of the writer was to develop a health knowledge test for adults, and these other student groups were included for comparative purposes. However, this first survey showed that the average adult does not know any more than the average college freshman who has not taken a course in college hygiene, and that the average freshman in turn knows only a little more than the average high school senior. On the basis of this finding the test was changed so that it would be usable for all three groups.

The original test was more difficult than the revised one.[1] The questions for the latter were selected from the first test and modified in such a way that the majority of students in a college hygiene course would be able to score 75 or better upon the completion of such a course. This point will be analyzed further in connection with the tables.

The one hundred questions in the test were selected from all major fields of health education—Nutrition, Safety and First Aid, Community Hygiene and Sanitation, Mental and Social Hygiene, Common Errors and Superstitions, and general fields of health. A few questions test attitudes rather than facts. A limited number of the questions deal with controversial topics. In such cases the correct answer has been selected as that one which the majority of medical and scientific opinions support. These questions have been included for the purpose of determining what students and adults believe about them. These questions have been provocative of discussion in classes where the test has

[1] Kilander Health Knowledge Test for High School Seniors and College Freshmen. (Ann Arbor, Michigan: Edwards Bros., 1937.)

been used in health instruction, particularly when the class previously had taken the test.

The questions were not grouped under related topics, such as nutrition, in order that the choice of answer to each question would not be influenced by related questions and also in order that those questions which dealt with superstitions would not be too obvious. The one hundred questions were also distributed so that the first fifty and the second fifty each contained approximately the same number of questions from each of the major topics.

Additional information such as sex, age, class, amount of science previously studied, and the occupation of the father was obtained about each individual. The I.Q.'s and the scholastic ratings were obtained where possible.

The statistical data in this article deals mainly with the high school seniors and college freshmen. Data from the adult groups is used in the analysis of individual questions. Other classes in some of the high schools and colleges were also tested but the results from these groups are only incidentally included in this paper and then mainly for comparative purposes. A total of 2800 individuals took the revised test.

All the schools included in the investigation are located in northern New Jersey. The colleges, two liberal arts and three teachers colleges, draw upon these same high schools for a large percentage of their students.

The following sampling was used for the analysis of the individual questions: 844 high school seniors, 504 college freshmen, and 430 adults. Among the adults were included various groups such as business men, firemen, stenographers, clerks, housewives, and teachers who made up one-third of this group. Most of the teachers were in the field of physical education. The higher scores of these teachers raised the average of the adult group. If the scores of the teachers were eliminated from the computations, the scores of the adult group would be about the same as that of the other groups.

All classes who took the test were cautioned not to deliberately guess at the answers in instances where they had no idea which might be the correct answer. This procedure accounts for the number who did not answer various questions as is indicated in the analysis of individual questions. By omitting the element of chance, or at least by reducing it, the results of the test become more reliable.

RESULTS AND CONCLUSIONS

Table I gives certain statistical data for 682 high school seniors from seven schools and 402 college freshmen from five colleges. The coefficient of reliability was obtained by comparing the scores on the odd-numbered questions with those on the even-numbered questions. Table

II shows the percentile scores for the high school seniors and college freshmen.

The range of scores is 22 to 82 for the high school seniors and from 33 to 85 for the college freshmen. The best score was 97 made by a college senior majoring in health and physical education. High school seniors scored an average (mean) of 56.15 and the college freshmen obtained an average of 62.70, a difference of 6.55 between these two groups. The range in the mean of the five college freshman classes is

TABLE I

COMPARISON OF RELIABILITY COMPUTED ON SCORES

	Cases	Total Points	Mean	Standard Deviation	Reliability
College Freshmen (5 colleges)	402	100	62.70	9.62	.80 ± .012
High School Seniors (7 schools)	682	100	56.15	10.20	.83 ± .007

TABLE II

TABLE OF TENTATIVE NORMS

	Raw Scores	
Percentile	High School Seniors	College Freshmen
99.5	82	85
90	70	75
84	67	73
75	63	69
50	56	63
25	49	56
16	47	53
10	44	51
0	22	33

from 59.30 to 66.25, and for the seven high school senior classes is from 50.65 to 60.25. The high school senior class with the highest mean scored higher than one of the college freshman classes and equalled the score of the next ranking freshman class. In the groups studied during the spring of 1936 one high school was found to have a mean higher than any of the college freshman groups. It was a small class of individuals who were above average in ability.

The averages (means) have been determined for all classes in three of the seven high schools. The results are as follows: High school "A" (with the weakest program in health education)—freshman, 38.8, sophomore, 43.7, junior, 48.0, senior, 50.7; High school "D"—freshman, 45.3, sophomore, 50.5, junior, 50.9, senior, 55.2; High school "E"—freshman, 45.7, sophomore, 51.3, junior, 55.2, senior, 56.0. All classes

were not tested in the other four high schools and therefore no reliable general average is available. The following general average consequently is based upon the averages of three schools only: freshman, 43.3, sophomore, 48.5, junior, 51.4, senior, 54.0.

Charts Nos. 1 and 2 give statistical and graphic comparisons of the various high school and college classes represented in the investigation. The charts show the range in scores, the lower and upper quartiles, the middle 50 per cent, and the mean for each class. Chart No. 2 also compares the scores and rankings of the upper three classes of two colleges. College "C" offers a hygiene course which is required only of those students who are majoring in education. It is elective to others. Approximately one-third of the students eventually take the course, usually in

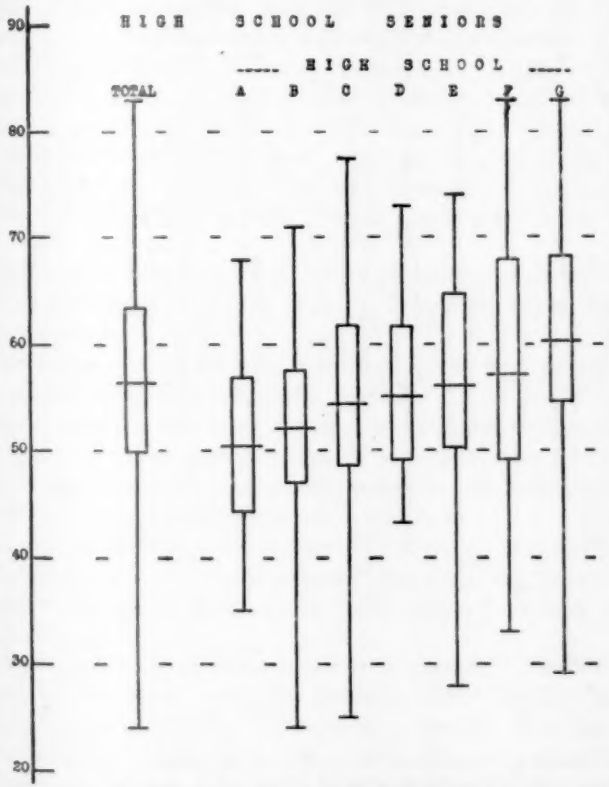

CHART I. DISTRIBUTION OF SCORES OF SENIORS IN SEVEN HIGH SCHOOLS.
Range—Total length of a given graph
Middle 50 per cent—rectangle
Lower quartile—line below rectangle
Upper quartile—line above rectangle
Mean—horizontal line across rectangle
Individual high schools represented by letters

the junior or senior years. College "E" requires hygiene of all freshmen. It is a four-credit course given through the entire year. Subjects related to health education are correlated in all four years.

The following conclusions are based upon the individual and group scores of the 2800 people who took the revised test:

1. Individual scores vary a great deal within a given class.

2. The mean rises in general for each successive year within a given school both on the high school and college level. Such a rise is most rapid for the first two to three years in high school.

3. The rise in the mean in the high school is related to the amount

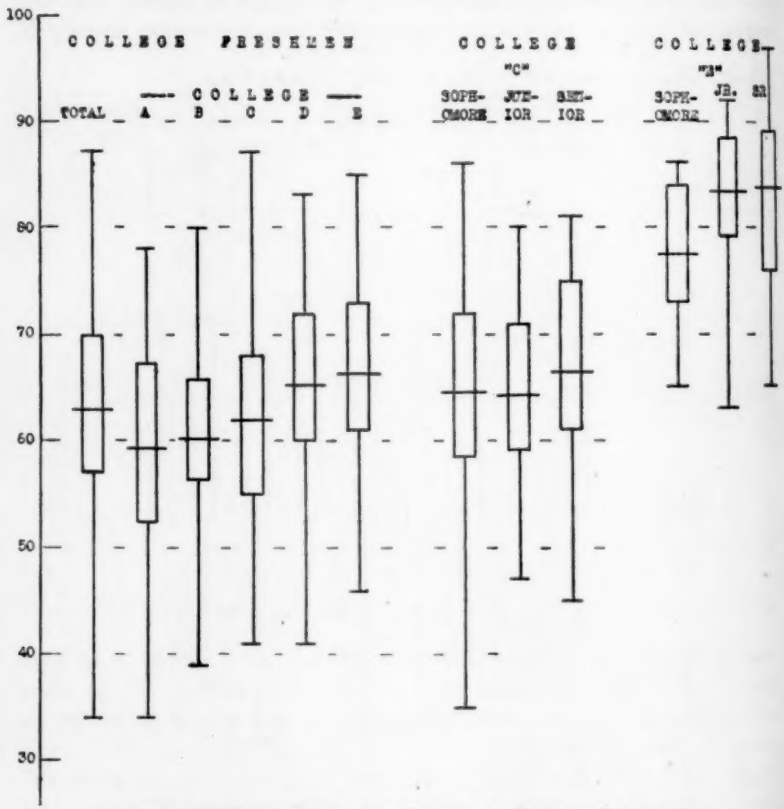

CHART II. DISTRIBUTION OF SCORES OF COLLEGE STUDENTS.

The chart shows the distribution of scores of the freshman classes in five colleges and the scores for all classes in two colleges. College "D" offers an elective course in the sophomore year. College "E" requires hygiene in the freshman year.
Range—Total length of a given graph
Middle 50 per cent—rectangle
Lower quartile—line below rectangle
Upper quartile—line above rectangle
Mean—horizontal line across rectangle
Individual colleges represented by letters

of health instruction received either in special health education classes or as a part of related subject fields such as the sciences.

4. The rise of 6.55 points in the mean of the college freshmen over that of the high school seniors is due to a large extent to the greater selectivity practiced in the colleges—there is a weeding out of the weaker students from the high schools.

5. The rise in the mean for each year in college is related mainly to the amount of specific instruction received in health education. Science courses on the college level contribute much less than on the high school level to an increase in health information as judged by this test. The content of science courses in the high schools includes more health material than in the colleges.

6. High scorers in a given class and with approximately the same educational background have the following characteristics: a higher intelligence, a more favorable home environment as judged by the occupations of the fathers, and they belong to certain racial groups. The latter point is partly explainable by the fact that the choice of occupations is frequently determined along racial or national lines. Certain racial groups were represented by more children of the first generation in this country which fact slightly lowered the average score of some classes.

7. High scorers in a given class where variations in the educational background exist have had more training in specific health education and science courses.

8. The factors which contribute to high scores tend to affect individual questions more than the test in general.

9. The average for all classes within a given grouping does not seem to differ much, but the class averages of individual schools vary considerably. Some classes score very high, sometimes higher than the best of the college freshmen, and others score very low.

10. A college education *per se* does not necessarily add to the health knowledge of students. College students of the same intelligence as high school seniors ordinarily do not score higher unless they have had specific health instruction.

11. A general peak of average scores is seemingly reached by the senior year in high school except in instances where specific training is received during the senior year or following graduation from high school. This generalization is arrived at from a comparison of the scores of all high school and college groups with the scores of adults who completed high school but did not continue their formal education.

12. Health instruction may not necessarily improve the score of the individual who already has a high score, but such instruction does definitely eliminate the low scorer by raising his grade to at least the average.

13. High scorers on the college level who have not taken a course in college hygiene are found to be interested students in such classes and seem to profit a great deal from additional teaching provided such teaching is sufficiently advanced to offer a challenge to the student.

14. On the basis of the percentile scores, a score of 63 or better for high school seniors and 69 or better for college freshmen may be considered a good score, provided the student has not recently had a separate course or special training in health education. A college student upon the completion of a hygiene course should score 75 or better. The "A" students should score at least 85.

THE HEALTH KNOWLEDGE TEST WITH CORRECT ANSWERS (*), AND ANALYSES

(Percentages based upon 844 high school seniors from 13 schools, 504 freshmen from 7 colleges, and 430 adults, one-third of whom are teachers)

	High School Seniors	College Freshmen	Adults		
1. IF A CHILD IS NEGLECTING HIS STUDIES FOR ATHLETICS THE PARENTS SHOULD:	%	%	%		
1. Assist him in his school work so that he can continue an extensive athletic program	5	6	2	..	..
2. Make him drop athletics	8	12	2	..	..
*3. Help him to see the desirability of both studies and athletics	87	82	96	..	..
4. Realize that these social contacts help more than book knowledge does	..	..	..	..	..
Unanswered	..	..	..	..	..
2. WHICH OF THE FOLLOWING FOODS IS A GOOD SUBSTITUTE FOR MEAT?					
1. Vegetable broth	33	21	9	..	..
2. Spinach	22	12	12	..	..
*3. Cheese	31	53	70	..	..
4. Bread	4	4	..	..	..
5. Potatoes	10	7	6	..	..
Unanswered	..	3	3	..	..
3. THE CHEMICAL AND PHYSICAL MAKE-UP OF NIGHT AIR AS COMPARED WITH DAY AIR IS:					
1. The same	40	46	36	..	..
2. Night air contains certain harmful substances	4	2	3	..	..
*3. The same except for higher humidity	41	33	49	..	..
4. Night air contains less oxygen	10	13	12	..	..
Unanswered	5	6	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
4. WHICH INDIVIDUAL IS BEST QUALIFIED TO EXAMINE YOUR EYES?					
*1. An oculist	54	51	72	..	..
2. A chiropractor	9	..	11	..	..
3. An optometrist	37	47	26	..	..
4. An osteopath	..	2	1	..	..
Unanswered	..	..	..	..	..
5. IF A CHILD WHO IS GOING TO SCHOOL IS LOSING WEIGHT AND DEVELOPING A NERVOUS DISPOSITION, HE SHOULD:					
1. Be allowed to leave school for a year	1	1	..	..	..
*2. Be given a thorough medical examination to determine the cause	90	91	98	..	..
3. Have his tonsils removed	1	1	..	..	..
4. Have his diet changed and regulated	8	7	2	..	..
Unanswered	..	..	..	..	..
6. CAN GOITER BE PREVENTED BY AMBER BEADS AROUND THE NECK?					
1. This procedure is frequently of value because amber in this way touches the skin over the thyroid gland which is enlarged when one has goiter	4	1	4	..	..
2. It is only of value when worn early enough, that is, before the person has been exposed to whatever it is that causes goiter	6	3	5	..	..
3. It is of doubtful value	13	9	14	..	..
*4. It is of no value	74	82	77	..	..
Unanswered	3	5	..	..	..
7. MANY PEOPLE LACK EMOTIONAL STABILITY IN ADULT LIFE. THIS CHARACTERISTIC MOST PROBABLY IS TRACEABLE TO:					
*1. Early home life	63	65	83	..	..
2. Early school life	11	13	4	..	..
3. Bad companions	21	16	10	..	..
4. Lack of church affiliation	2	4	3	..	..
Unanswered	3	2	..	..	..
8. WHICH TEMPERATURE OF THE BATH WATER IS MOST CONDUCIVE TO RELAXATION WHEN ONE IS NERVOUS?					
1. Hot	11	20	14	..	..
*2. Warm	54	47	61	..	..
3. Cold	5	7	6	..	..
4. Hot followed by cold	26	25	19	..	..
Unanswered	4	1	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
9. IT IS NOT ADVISABLE TO USE CATHARTICS AND LAXATIVES REGULARLY BECAUSE THEY:					
*1. Weaken the muscle tone of the intestines	71	76	85	..	..
2. Destroy the enzymes of digestion	15	15	10	..	..
3. Do not allow the food to digest sufficiently	11	8	5	..	..
4. Make the person thin	1	..	..	..	..
Unanswered	2	1	..	..	..
10. FATIGUE DUE TO SEDENTARY OR MENTAL WORK IS BEST RELIEVED AT THE END OF ONE'S WORKING HOURS BY:					
1. Coffee	1	..	..	..	..
2. Sleep	29	26	10	..	..
3. A shower	9	9	4	..	..
*4. Recreational activity of a physical type.	61	65	86	..	..
Unanswered	..	..	..	..	..
11. IN GIVING ARTIFICIAL RESPIRATION THE PROPER POSITION FOR THE PATIENT IS LYING:					
1. On his stomach over a barrel	1	2	6	..	..
2. On his back	1	6	9	..	..
*3. On his stomach with face turned to one side	98	89	83	..	..
4. On his left side	..	2	2	..	..
Unanswered	..	1	..	..	..
12. A FEVER CAN BE "KILLED" BY DRINKING WHISKEY.					
1. This is true	2	1	1	..	..
2. There is neither harm nor value in this method	6	9	11	..	..
3. It frequently helps	11	13	5	..	..
*4. It is more dangerous than helpful	80	74	83	..	..
Unanswered	1	3	..	..	..
13. DOCTORS GENERALLY CONSIDER BOTTLE FEEDING OF INFANTS AS COMPARED TO BREAST FEEDING TO BE:					
1. Better	14	10	8	..	..
2. Just as good	8	12	8	..	..
*3. Poorer	43	51	50	..	..
4. Debatable	30	25	34	..	..
Unanswered	5	2	..	..	..
14. THE DANGERS OF VENEREAL DISEASES SHOULD BE EXPLAINED TO CHILDREN:					
1. When they begin to show interest in the opposite sex	16	16	15	..	..

	H.S.S. %	C.F. %	Ad'lts %		
*2. During adolescence as a part of sex instruction	61	62	69	..	..
3. When the child leaves home for a college or business career	1	2	1	..	..
4. When parents suspect the children are thinking about such things	17	18	15	..	..
Unanswered	5	2	..	..	..
15. WHICH IS THE BEST WAY TO ARRANGE A CHAIR AND WRITING DESK IN A ROOM WITH WINDOWS ONLY ON ONE SIDE AND FOR A RIGHT-HANDED PERSON?					
1. Facing windows	7	5	3	..	..
2. With right side toward windows	12	11	3	..	..
3. With back to windows	13	6	15	..	..
*4. With left side to windows	68	77	79	..	..
Unanswered	..	1	..	..	..
16. THE ULTRA-VIOLET RAYS EITHER FROM SUNLIGHT OR ARTIFICIAL SUN LAMPS ARE OF VALUE IN TREATING:					
*1. Rickets	61	79	94	..	..
2. Goiter	1	3	..	..	..
3. Cancer	24	12	3	..	..
4. Kidney trouble	12	1	3	..	..
Unanswered	2	5	..	..	..
17. THE MOST FREQUENT PORTAL OF ENTRY INTO THE BODY OF DISEASE PRODUCING GERMS IS:					
1. Skin	8	11	6	..	..
2. Nose	13	15	17	..	..
*3. Mouth	74	70	71	..	..
4. Alimentary Canal	2	3	6	..	..
Unanswered	3	1	..	..	..
18. SPINACH, EITHER RAW OR COOKED IS ESPECIALLY RICH IN:					
1. Calcium	3	3	2	..	..
2. Phosphorus	1	1	1	..	..
3. Iodine	5	2	3	..	..
*4. Iron	91	94	94	..	..
Unanswered	..	..	..	..	..
19. CAN A PROSPECTIVE MOTHER MAKE HER CHILD MORE MUSICAL IF SHE LISTENS TO GOOD MUSIC?					
1. Yes, several prominent musicians can ascribe their musical ability to such a procedure	7	2	2	..	..
2. It is doubtful that it would have such an effect	36	28	26	..	..

	H.S.S. %	C.F. %	Ad'lts %		
3. Probably, if the mother does so during the pre-natal period	4	5	6	..	..
*4. It is contrary to the facts of heredity to expect this	51	64	66	..	..
Unanswered	2	1	..	..	..
20. A PERSON HAS CUT AN ARTERY IN THE FOREARM. A TOURNIQUET SHOULD BE APPLIED:					
1. On the side of the cut toward the wrist	6	6	6	..	..
2. Either at wrist or elbow	4	2	4	..	..
*3. On the side of the cut toward the elbow	74	78	81	..	..
4. Both at wrist and elbow	12	11	9	..	..
Unanswered	4	3	..	..	..
21. THE MOST SERIOUS TYPE OF FATIGUE IS INDUCED BY:					
1. Physical work	11	9	6	..	..
2. Mental work	18	21	19	..	..
*3. Emotional strain	70	69	75	..	..
Unanswered	1	1	..	..	..
22. FROM WHICH DISEASE IS THERE RARELY RECOVERY AFTER ACQUIRING IT?					
*1. Tetanus (lockjaw)	81	75	88	..	..
2. Mumps	2	1	1	..	..
3. Chickenpox	1	..	2	..	..
4. Hookworm	2	5	6	..	..
5. Scurvy	12	17	3	..	..
Unanswered	2	2	..	..	..
23. PARENTS SHOULD DEVELOP IN THEIR SONS THE ATTITUDE THAT GIRLS ARE:					
1. People who are trying to take man's place in everything	..	1	..	..	..
2. Something that is a biological necessity for the life of the race	9	16	13	..	..
*3. Beings like themselves among whom they will find many good friends and eventually a mate	90	81	87	..	..
4. The weaker sex, physically and mentally	1	1	..	..	..
Unanswered	..	1	..	..	..
24. THE MOST DISTRESSING AND UNCOMFORTABLE TYPE OF CLIMATE OR WEATHER IS:					
1. Hot and dry	21	13	3	..	..
*2. Hot and moist	41	51	64	..	..
3. Cold and dry	2	..	..	..	..
4. Cold and damp	36	35	33	..	..
Unanswered	..	1	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
25. FOR PEOPLE AT SEDENTARY WORK, 68 DEGREES IS THE IDEAL ROOM TEMPERATURE BECAUSE:					
1. It keeps the humidity sufficiently low...	13	9	7	..	..
2. We are accustomed to that temperature.	2	4	5	..	..
*3. It is the temperature at which our body makes heat at the same rate that it loses it without shivering or perspiring.....	80	85	86	..	..
4. It is the nearest temperature to that of summer	2	1	2	..	..
Unanswered	3	1	..	..	..
26. THE BEST METHOD TODAY OF REDUCING THE DEATH RATE FROM CANCER IS BY:					
*1. Early diagnosis	52	54	79	..	..
2. Repeated use of radium and X-ray.....	14	15	12	..	..
3. Improvement in one's general health....	30	29	9	..	..
Unanswered	4	2	..	..	..
27. IS IT TRUE THAT LEAVING RUBBERS ON THE FEET INDOORS TOO LONG MAY CAUSE EYE TROUBLE?					
1. This is true as is evidenced by many known cases	12	11	5	..	..
2. It is likely to cause eye trouble only when the rubbers are worn unnecessarily long in cold, dry weather.....	10	10	4	..	..
3. There are only a few known instances where this has happened.....	5	6	4	..	..
*4. There is no scientific or medical basis for this statement	71	71	87	..	..
Unanswered	2	2	..	..	..
28. THE COOKING OF FOOD DECREASES THE VALUE OF:					
1. Proteins	23	26	11	..	..
2. Starch	9	5	5	..	..
*3. Vitamins	39	47	70	..	..
4. Calories	13	11	6	..	..
5. Fats	9	7	8	..	..
Unanswered	7	4	..	..	..
29. IS THE "TASTE" FOR ALCOHOL INHERITED?					
1. Yes	..	1	..	..	..
2. Yes, in some cases.....	11	19	24	..	..
3. Yes, in most cases.....	..	1	..	..	..
*4. No	88	78	76	..	..
Unanswered	1	1	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
30. WHEN A STRONG ACID HAS ACCIDENTALLY COME IN CONTACT WITH THE SKIN, ONE SHOULD IMMEDIATELY:					
*1. Wash it off with plenty of water, preferably alkaline	55	53	40	..	..
2. Cover it with oil	15	17	35	..	..
3. Apply an ointment dressing	15	16	16	..	..
4. Wash it off with rubbing alcohol	8	10	7	..	..
Unanswered	7	4	2	..	..
31. ASTIGMATISM IS DEFINED AS:					
1. An infection of the eye	14	15	12	..	..
2. Weak eyes	14	10	13	..	..
3. A type of nearsightedness	21	19	17	..	..
*4. Imperfect curvature of the eye	40	47	57	..	..
Unanswered	11	9	1	..	..
32. GONORRHEA IS FREQUENTLY THE CAUSE OF:					
1. Arthritis	9	14	7	..	..
2. Insanity	14	21	24	..	..
3. Baldness	7	7	3	..	..
*4. Sterility	42	38	66	..	..
Unanswered	28	20	..	..	..
33. THE NUMBER OF CASES OF ORGANIC DISEASES SUCH AS HEART TROUBLE, CANCER, ETC., COMPARED WITH COMMUNICABLE DISEASES SUCH AS TYPHOID, TUBERCULOSIS, DIPHTHERIA, ETC., IS:					
*1. Increasing	34	46	66	..	..
2. The same	6	8	5	..	..
3. Decreasing	40	33	22	..	..
4. Not known	6	7	7	..	..
Unanswered	14	6	..	..	..
34. IN WHICH WAY IS SUGAR USED IN THE BODY?					
*1. To yield energy	59	66	69	..	..
2. To build tissue	6	5	3	..	..
3. To regulate the body processes	8	4	10	..	..
4. To yield energy and build tissue	26	24	18	..	..
Unanswered	1	1	..	..	..
35. THE SOURING OF MILK IS HASTENED MOST QUICKLY BY:					
1. Thunderstorms	2	6	9	..	..
2. Pasteurization	2	3	3	..	..
3. Leaving the bottle uncovered in the refrigerator	6	4	3	..	..
*4. Poor refrigeration	90	87	85	..	..
Unanswered	..	..	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
36. WHAT ATTITUDE SHOULD ONE HAVE TOWARD MEDICAL DOCTORS IN COMPARISON WITH CHIROPRACTORS?					
1. Equal to chiropractors	39	28	25	..	..
2. Inferior	6	7	2	..	..
*3. Better	48	59	73	..	..
4. Of no value	1	1	..	..	..
Unanswered	6	5	..	..	..
37. FREEDOM FROM COMMUNICABLE DISEASES SUCH AS SMALLPOX AND TYPHOID FEVER IS BEST ACCOMPLISHED BY:					
1. Maintaining good health	28	21	23	..	..
2. Avoiding all crowds	1	2	1	..	..
*3. Being vaccinated against them	70	77	76	..	..
4. Having a touch of the disease	1	..	..	..	..
Unanswered	..	..	..	..	..
38. IN ATTEMPTING TO REDUCE THE RATE OF TUBERCULOSIS THIS DISEASE SHOULD BE CONSIDERED PRIMARILY:					
1. An hereditary sickness	20	14	21	..	..
*2. An infection	41	43	47	..	..
3. An emotional ailment	2	2	1	..	..
4. As caused by faulty nutrition	35	40	31	..	..
Unanswered	2	1	..	..	..
39. IN ADDITION TO NICOTINE, A SECOND HARMFUL SUBSTANCE FOUND IN APPRECIABLE QUANTITY IN TOBACCO SMOKE IS:					
1. Carbon dioxide	40	21	43	..	..
*2. Carbon monoxide	34	44	39	..	..
3. Ammonia	9	7	3	..	..
4. Nitrogen	13	7	9	..	..
Unanswered	4	21	6	..	..
40. WE SHOULD THINK OF AIR IN ITS RELATION TO COMMUNICABLE DISEASES AS:					
1. An important means of transmitting bacteria	37	49	38	..	..
2. A substance in which bacteria readily grow	17	9	10	..	..
*3. Of very little danger unless droplets of human saliva are present	40	37	52	..	..
Unanswered	6	5	..	..	..
41. WHICH DISEASE IS TRANSMITTED MOST READILY AND QUICKLY BY SOCIAL CONTACT?					
1. Cancer	2	2	1	..	..

	H.S.S. %	C.F. %	Ad'lts %		
2. Pellagra	2	2	4	..	..
3. Nephritis	4	2	2	..	..
4. Anemia	1	..	1	..	..
*5. Diphtheria	78	86	91	..	..
Unanswered	13	8	1	..	..
42. MILK COMPLETELY LACKS WHICH ONE OF THE FOLLOWING FOOD ESSENTIALS?					
1. Proteins	2	1	2	..	..
2. Fats	4	4	3	..	..
3. Carbohydrates	7	5	8	..	..
4. Minerals	13	14	1	..	..
*5. Roughage	71	70	86	..	..
6. Vitamins	3	4	..	..	..
Unanswered	..	2	..	..	..
43. WHICH ONE OF THESE FACTORS CONTRIBUTES MOST TO MENTAL HEALTH?					
1. Daydreaming	3	1	1	..	..
*2. Facing the realities of life	58	57	69	..	..
3. Learning difficult tasks	8	14	4	..	..
4. A great deal of introspection	26	21	21	..	..
5. Seldom facing unpleasant situations	4	3	4	..	..
Unanswered	1	4	1	..	..
44. SENSITIVENESS TO PROTEINS CONTAINED IN POLLEN, FEATHERS, ETC., IS THE CAUSE OF:					
1. Tuberculosis	5	3	3	..	..
2. Gout	2	3	..	..	..
3. Arthritis	1	4	3	..	..
4. Pyorrhea	2	..	..	..	..
*5. Hay Fever	84	83	91	..	..
Unanswered	6	7	3	..	..
45. WHICH FACTOR MOST FREQUENTLY MAKES THE AIR LESS HEALTHFUL IN THE HOME OR OFFICE DURING THE WINTER?					
*1. Room temperature too high	52	45	40	..	..
2. Dampness	10	11	12	..	..
3. Lack of sufficient oxygen	20	31	34	..	..
4. Too much carbon dioxide	17	13	14	..	..
Unanswered	1	..	..	..	..
46. WEAK OR FALLEN ARCHES MOST FREQUENTLY RESULT FROM THE WORK DONE BY:					
1. Mail Carriers	43	43	54	..	..
*2. Store clerks	40	36	32	..	..
3. Teachers	8	9	7	..	..
4. Athletes	6	7	6	..	..
Unanswered	3	5	1	..	..

	H.S.S. %	C.F. %	Ad'lts %		
47. A GOOD REMEDY TO USE IN THE CASE OF A SNAKE BITE IS:					
1. Whiskey taken internally	2	5	5	..	..
2. A bandage placed immediately on the wound	5	2	2	..	..
*3. The promotion of free bleeding	91	91	91	..	..
4. Spirits of ammonia taken internally	1	1	2	..	..
Unanswered	1	1	..	..	..
48. APPROXIMATELY HOW MANY CALORIES DOES THE AVERAGE HIGH SCHOOL BOY NEED DAILY?					
1. 1500-2500	8	7	10	..	..
*2. 2500-3500	41	38	50	..	..
3. 3500-4500	26	32	27	..	..
4. 4500-5500	6	8	10	..	..
Unanswered	19	15	3	..	..
49. ANTITOXIN PERTAINS TO:					
1. Determination of susceptibility to a disease	19	11	17	..	..
*2. Immunization	45	51	57	..	..
3. Sterilization	13	13	5	..	..
4. A cure for a disease	17	19	21	..	..
Unanswered	6	6	..	..	..
50. WHAT VALUE IS THERE IN SINGEING THE HAIR?					
*1. It is of no value	84	82	62	..	..
2. It is of value only in preventing hairs from splitting	9	11	29	..	..
3. It is of value in preventing the hair from bleeding	5	3	9	..	..
Unanswered	2	4	..	..	..
51. HAVING WHICH DISEASE DOES NOT MAKE THE PERSON IMMUNE TO A SECOND ATTACK OF THE DISEASE?					
*1. Colds	54	75	70	..	..
2. Mumps	17	9	9	..	..
3. Scarlet fever	19	12	15	..	..
4. Typhoid fever	8	4	6	..	..
Unanswered	2	..	..	..	..
52. THE OXYGEN TAKEN IN BY THE LUNGS IS CARRIED TO THE BODY TISSUES BY WHICH ONE OF THE FOLLOWING SUBSTANCES?					
1. White blood cells	18	21	12	..	..
2. Blood platelets	5	6	8	..	..
*3. Red blood cells	68	65	72	..	..
4. Autocoids	3	3	5	..	..
Unanswered	6	5	3	..	..

	H.S.S. %	C.F. %	Ad'lts %		
53. THE BASAL METABOLISM AT THE AGE OF 14 AS COMPARED WITH THE AGE OF 40 IS:					
*1. Higher	41	40	53	..	..
2. The same	3	6	5	..	..
3. Lower	24	24	24	..	..
4. Not definitely known	10	9	14	..	..
Unanswered	22	21	4	..	..
54. THE FEDERAL FOOD AND DRUG ACT PROHIBITS:					
1. False advertising in newspapers	10	5	8	..	..
2. The sale of the products in the same state in which they are made	1	1	1	..	..
*3. False advertising on the package	84	88	82	..	..
4. Both sale and advertising of the product	5	5	8	..	..
Unanswered	..	1	1	..	..
55. IN TESTING FOR GLASSES, DROPS ARE PUT INTO THE EYES PRIMARILY TO:					
*1. Relax the muscles of accommodation	62	53	60	..	..
2. Keep the eyes from crossing	1	1	1	..	..
3. Aid in getting accustomed to glasses	6	6	5	..	..
4. Make the pupils large	26	35	34	..	..
Unanswered	5	5	..	..	..
56. WHICH ONE OF THE FOLLOWING IS FAVORABLE FOR THE MAINTENANCE OF A HEALTHY MIND?					
1. Introspection	6	17	3	..	..
2. Monotonous living	3	..	..	..	..
*3. Cultivation of hobbies	87	76	97	..	..
4. Emotionalizing over one's handicaps	3	5	..	..	..
Unanswered	1	2	..	..	..
57. THE MAIN CAUSE OF ABSENCES AMONG SCHOOL CHILDREN IS:					
*1. Colds	91	90	97	..	..
2. Accidents	..	1	..	..	..
3. Headaches	5	2	3	..	..
4. Indigestion	2	5	..	..	..
Unanswered	2	2	..	..	..
58. IF YOU SLEEP 8 HOURS A NIGHT, DURING WHICH ONE OF THE FOLLOWING HOURS IS YOUR SLEEP MOST SOUND?					
1. First	16	21	33	..	..
*2. Second	37	35	49	..	..
3. Fourth	20	20	6	..	..
4. Sixth	17	14	3	..	..
5. Eighth	9	4	9	..	..
Unanswered	1	6	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
59. THE RELATIVE HUMIDITY (EXPRESSED IN PERCENTAGE OF SATURATION AT 68 DEGREES F.) DESIRABLE IN A HOME OR SCHOOL IS:					
1. 20-40%	7	18	21	..	..
*2. 40-60%	48	37	49	..	..
3. 60-80%	36	20	24	..	..
4. 80-100%	1	2	3	..	..
Unanswered	8	23	3	..	..
60. THE MAIN FUNCTION IN PERSPIRING (SWEATING) IS:					
1. To eliminate body poisons	43	49	54	..	..
*2. To regulate the temperature of the body	50	38	40	..	..
3. To get rid of excess water	5	10	5	..	..
4. To cleanse the surface of the body	2	3	1	..	..
Unanswered	..	..	..	..	..
61. VARIOUS MARKS OF DISFIGURATION ON A NEWBORN CHILD ARE DUE TO THE FRIGHT OF THE MOTHER DURING PREGNANCY.					
1. This has frequently happened	15	13	11	..	..
2. It may happen when the fright occurs early in pregnancy	10	5	7	..	..
3. It may happen when the fright occurs during last 3 or 4 months of pregnancy	16	11	20	..	..
*4. There is no biological basis for this statement	54	69	62	..	..
Unanswered	5	2	..	..	..
62. CHRONIC HIGH BLOOD PRESSURE IS MOST FREQUENTLY ASSOCIATED WITH THE DISORDER OF:					
1. Stomach	11	13	24	..	..
2. Liver	28	33	27	..	..
3. Pancreas	11	13	10	..	..
*4. Kidneys	28	25	37	..	..
Unanswered	22	16	2	..	..
63. THE PRESENCE OF WHICH SUBSTANCE IN THE BODY CONTRIBUTES TO MUSCULAR FATIGUE?					
1. Glycogen	14	19	21	..	..
*2. Lactic acid	39	53	67	..	..
3. Oxygen	8	6	..	..	..
4. Glucose	26	6	6	..	..
Unanswered	13	16	6	..	..
64. WHICH IS THE CORRECT VIEW IN REGARD TO "COUSIN MARRIAGE"?					
1. Such a marriage almost always results in some inferior children	10	6	7	..	..

	H.S.S. %	C.F. %	Ad'lts %		
2. It frequently results in mentally deficient children	11	15	14	..	..
3. It is not likely to result in deficient children any more than any other marriage	19	14	10	..	..
*4. It is biologically undesirable if undesirable inheritable traits are known to be present in the family	59	65	69	..	..
Unanswered	1	..	..	..	..
65. THE SCHICK TEST IS VALUABLE IN THE EXAMINATION OF SCHOOL CHILDREN BECAUSE IT:					
1. Prevents the spread of diphtheria	28	27	22	..	..
*2. Indicates whether or not the child is immune to diphtheria	60	58	68	..	..
3. Indicates the presence of scarlet fever	2	3	5	..	..
4. Protects the child against scarlet fever	10	11	5	..	..
Unanswered	..	1	..	..	..
66. THE DANGEROUS GAS CONTAINED IN MANUFACTURED ILLUMINATING AND COOKING GAS IS:					
1. Methane	18	16	20	..	..
2. Hydrogen	6	7	6	..	..
*3. Carbon monoxide	56	57	50	..	..
4. Carbon dioxide	17	14	22	..	..
Unanswered	3	6	2	..	..
67. TO WHAT EXTENT IS HEALTH ADVERTISING OVER THE RADIO RELIABLE AND ACCURATE?					
1. Very reliable, as it is censored before being broadcast	8	8	10	..	..
2. Very reliable, although it is not censored for accuracy	6	5	8	..	..
3. Most of it is reliable and can be believed by the radio public	13	14	27	..	..
*4. It is of questionable reliability	73	71	55	..	..
Unanswered	..	2	..	..	..
68. IN ORDER TO RECOVER FROM TUBERCULOSIS, WHICH PROCEDURE IS MOST IMPORTANT?					
*1. To rest a great deal	44	43	41	..	..
2. To move to a dry climate	48	50	51	..	..
3. To exercise by taking long walks	3	4	..	..	..
4. To take injections of tuberculin	3	2	7	..	..
Unanswered	2	1	1	..	..
69. DURING WHICH AGE PERIOD WILL THE LACK OF PROPER FOOD RESULT IN MOST HARM?					
*1. From birth to 6 years	59	57	78	..	..
2. Childhood—6-12 years	16	17	10	..	..
3. Adolescence—12-18 years	22	20	9	..	..

	H.S.S. %	C.F. %	Ad'lts %		
4. Early maturity—18-24 years	2	3	2	..	..
Unanswered	1	3	1	..	..
70. IS FISH A BRAIN FOOD?					
1. It is, because fish is rich in protein similar to that found in the brain	6	4	3	..	..
2. It is of value because it contains quantities of the salts found in the brain	5	4	4	..	..
3. It is doubtful whether enough fish can be eaten to make much difference	18	13	15	..	..
*4. No one type of food is used specifically for one organ or region such as the brain	68	77	78	..	..
Unanswered	3	2	..	..	..
71. CAN COMMUNICABLE DISEASES BE INHERITED (CONSIDER ONLY BIOLOGICAL INHERITANCE)					
1. Many but not all communicable diseases can be inherited	14	12	12	..	..
2. It is only occasionally that such diseases are inherited	16	13	14	..	..
3. Tuberculosis is one of the two or three diseases that may be inherited	16	15	21	..	..
*4. Communicable diseases cannot be inherited	50	58	53	..	..
Unanswered	4	2	..	..	..
72. IF YOU HAVE AN INFECTION (A BEGINNING BOIL) ON THE SKIN IT IS BEST TO:					
1. Put iodine on it	8	12	6	..	..
2. Cut it open	2	11	2	..	..
*3. Leave it alone	47	27	61	..	..
4. Squeeze out the pus	1	4	3	..	..
5. Open it with a sterile needle	41	45	28	..	..
Unanswered	1	1	..	..	..
73. CAN RHEUMATISM BE CURED BY THE APPLICATION OF RATTLESNAKE (OR OTHER SNAKE) OIL?					
1. This is an old, reliable remedy used in the west	8	8	3	..	..
2. It is known to have helped in many instances	6	4	4	..	..
*3. There is no value in this remedy	77	77	85	..	..
4. Snake oil will cure only when rubbed in thoroughly	8	7	7	..	..
Unanswered	1	4	1	..	..
74. VENEREAL DISEASES (SYPHILIS AND GONORRHEA) ARE MOST FREQUENTLY CONTRACTED IN WHICH AGE GROUP?					
1. 14-19 years	12	15	10	..	..
*2. 19-24 years	52	43	72	..	..

	H.S.S. %	C.F. %	Ad'lts %		
3. 24-30 years	15	15	11	..	..
4. 30-36 years	8	5	3	..	..
5. 36-50 years	6	6	1	..	..
Unanswered	7	16	3	..	..
75. WHICH FOOD IN THE INDICATED AMOUNTS HAS THE HIGHEST VALUE IN CALORIES (FATTENING VALUE)?					
1. A potato	29	37	25	..	..
2. A slice of white bread	9	12	11	..	..
3. A head of lettuce	8	5	2	..	..
*4. A glass of whole milk	49	44	61	..	..
Unanswered	5	2	1	..	..
76. HANDLING TOADS OR FROGS IS A CAUSE OF WARTS FORMING ON THE HANDS.					
1. This statement is true	3	4	2	..	..
2. It is true only for toads not for frogs	3	4	1	..	..
3. It is doubtful whether frogs or toads can cause warts	16	14	13	..	..
*4. Both animals can be handled without fear of getting warts from them	78	77	84	..	..
Unanswered	..	1	..	..	..
77. ANEMIA IS A DISEASE IN WHICH THE INDIVIDUAL DOES NOT HAVE SUFFICIENT:					
1. Gastric juices	7	6	2	..	..
*2. Red corpuscles	69	75	95	..	..
3. Bile	6	3	1	..	..
4. Insulin	6	6	1	..	..
Unanswered	12	10	1	..	..
78. MALARIA IS A DISEASE WHICH IS TRANSMITTED TO MAN BY A CERTAIN TYPE OF:					
1. Bedbug	..	..	..	..	..
2. Housefly	4	3	2	..	..
*3. Mosquito	95	96	97	..	..
4. Cockroach	1	1	..	..	..
Unanswered	..	..	1	..	..
79. WHICH GLAND IS PROBABLY OVER-ACTIVE IN THOSE INDIVIDUALS WHO ARE NERVOUS, THIN AND HIGH STRUNG?					
1. Adrenal	14	14	18	..	..
2. Thymus	9	13	10	..	..
*3. Thyroid	53	38	55	..	..
4. Pituitary	14	15	13	..	..
Unanswered	10	20	4	..	..

	H.S.S. %	C.F. %	Ad'lts %		
80. THE PRESENT ANNUAL DEATH RATE, IN THIS COUNTRY, PER 1000 POPULATION IS ABOUT:					
1. 5	12	11	11	..	..
*2. 11	30	28	33	..	..
3. 36	20	22	31	..	..
4. 48	11	15	16	..	..
Unanswered	27	24	9	..	..
81. THE MAIN VALUE IN THE USE OF A DENTRIFICE (TOOTHPASTE OR POWDER) IS TO:					
*1. Help scour the teeth	40	47	63	..	..
2. Kill bacteria in the mouth	39	38	26	..	..
3. Neutralize bad mouth odors	10	8	6	..	..
4. It has no value	4	5	5	..	..
Unanswered	7	2	..	..	..
82. IT IS THROUGH THE EUSTACHIAN TUBE THAT INFECTIONS IN THE NOSE FREQUENTLY SPREAD TO:					
1. Lungs	28	24	6	..	..
2. Mouth	7	5	9	..	..
3. Tonsils	3	5	6	..	..
4. Adenoids	23	6	9	..	..
*5. Ear	35	47	70	..	..
Unanswered	4	13	..	..	..
83. THE BEST THING FOR YOU TO DO WHEN YOU HAVE DEVELOPED A BAD COLD IS TO:					
1. Take a laxative	24	25	33	..	..
*2. Go to bed	61	53	64	..	..
3. Eat less food	4	7	1	..	..
4. Take a good work-out	2	5	1	..	..
5. Gargle your throat	8	9	1	..	..
Unanswered	1	1	..	..	..
84. THE CORRECT ATTITUDE FOR PARENTS TO TAKE IN REGARD TO THE SO-CALLED CHILDREN'S DISEASES SUCH AS MUMPS, MEASLES, SCARLET FEVER, SMALLPOX, DIPHTHERIA IS THAT:					
*1. These diseases are to be guarded against as far as possible because they frequently leave permanent injuries to the body	82	84	84	..	..
2. The children might just as well have these diseases early since they will most likely have them eventually anyway	8	8	4	..	..

	H.S.S. %	C.F. %	Ad'lts %		
3. It is best to permit them to play with other children as it will help them to build up their resistance against these diseases	8	8	12	..	..
Unanswered	2	..	..	..	..
85. CAN A SWELLING OR A "BLACK EYE" DUE TO A BRUISE BE REDUCED BY APPLYING RAW MEAT?					
1. It works in many instances because raw meat is able to absorb the liquid which otherwise would cause the swelling to develop	19	15	4	..	..
2. Statement (1) holds true only for certain kinds of meat such as beafsteak	21	21	16	..	..
*3. There is no special value in the use of raw meat in the treatment of bruises	57	60	79	..	..
Unanswered	3	4	1	..	..
86. TUBERCULOSIS IN CHILDHOOD IS ACQUIRED MOST FREQUENTLY BY GETTING THE GERMS:					
1. Through inheritance	14	12	17	..	..
2. From street dust	9	8	8	..	..
*3. From contact with adults who have the disease	27	28	38	..	..
4. By drinking milk from infected cows	48	50	37	..	..
Unanswered	2	2	..	..	..
87. IS IT TRUE THAT EXCESSIVE USE OF THE BRAIN WILL LEAD TO BALDNESS?					
1. There is a high correlation between excessive brain work and baldness which fact therefore indicates that such work is the cause of baldness	1	4	2	..	..
2. It is true because more brain workers wear hats which fit too tightly	2	..	2	..	..
*3. There is no connection between baldness and brain work—people who are not engaged in brain work may become bald	95	96	96	..	..
Unanswered	2	..	..	..	..
88. WHICH VITAMIN SHOULD CHILDREN EAT IN ORDER TO PREVENT RICKETS?					
1. A	10	11	16	..	..
2. B	11	10	6	..	..
3. C	8	11	9	..	..
*4. D	51	45	66	..	..
5. E	2	3	3	..	..
6. G	3	6	..	..	..
Unanswered	15	14	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
89. FROM THE VIEWPOINT OF HEALTH, STANDING IS NOT TO BE CONSIDERED DESIRABLE EXERCISE BECAUSE:					
1. It tires the body	25	31	15	..	..
*2. It does not speed up the circulation	39	37	55	..	..
3. It does not use up enough energy	33	30	30	..	..
Unanswered	3	2	..	..	..
90. THE HIGHER SUMMER DEATH RATE OF INFANTS CAN BEST BE REDUCED BY:					
*1. A more sanitary handling of their food	73	72	88	..	..
2. Earlier feeding of solid food	4	7	2	..	..
3. A healthier condition of the mothers	16	14	9	..	..
4. Getting them to walk earlier	2	3	..	..	..
Unanswered	5	4	1	..	..
91. A CHILD SHOULD BE INFORMED ON THE MATTERS OF SEX HYGIENE:					
1. Before he enters first grade	3	..	2	..	..
2. When he reaches high school	16	27	7	..	..
3. When the parents think that he is in danger of receiving false information	16	11	8	..	..
*4. Beginning in early childhood when and as the subject comes up naturally	65	61	83	..	..
Unanswered	..	1	..	..	..
92. IN ITS EFFECT UPON THE SMOKER, TOASTED AS COMPARED WITH UNTOASTED TOBACCO IN CIGARETTES IS:					
*1. About as harmful	68	69	68	..	..
2. Less harmful	13	17	17	..	..
3. More harmful	7	4	4	..	..
4. Of no harm	7	4	11	..	..
Unanswered	5	6	..	..	..
93. THE PERIODIC HEALTH EXAMINATION IS VALUABLE IN THE DETECTION AND PREVENTION OF ALL EXCEPT WHICH ONE OF THESE DISEASES?					
*1. Typhoid fever	20	32	58	..	..
2. Heart disease	17	13	15	..	..
3. Bright's disease	10	14	3	..	..
4. High blood pressure	7	3	3	..	..
5. Cancer	40	27	12	..	..
Unanswered	6	11	9	..	..
94. IN WHICH SITUATION DOES GLARE EXIST?					
*1. When facing a window from the inside of the room at a distance of 20 feet	57	54	61	..	..

	H.S.S. %	C.F. %	Ad'lts %		
2. When standing close to a window looking out	39	37	39	..	..
3. When standing with one's back to the window	3	3	..	..	..
Unanswered	1	6	..	..	..
95. THE PHYSIOLOGICAL EFFECT OF ALCOHOL UPON THE NERVOUS SYSTEM IS:					
1. As a stimulant	27	30	34	..	..
*2. As a narcotic (depressant)	22	19	19	..	..
3. As both a narcotic and a stimulant	48	47	43	..	..
Unanswered	3	4	4	..	..
96. THE LIFE SPAN DURING THE PAST CENTURY HAS BEEN INCREASED FROM ABOUT 30 YEARS TO NEARLY 60 YEARS. THIS CHANGE HAS BEEN ACCOMPLISHED MAINLY BY:					
*1. Preventing infant deaths	29	20	43	..	..
2. Postponing adult deaths	11	11	15	..	..
3. Equally by both (1) and (2)	31	50	33	..	..
4. It is not definitely known	29	12	9	..	..
Unanswered	..	7	..	..	..
97. THE BEST THING TO DO WHEN FATIGUED FROM A STRENUOUS DAY OF MUSCULAR WORK IS TO:					
1. Take a cold shower to "pep one up"	19	16	13	..	..
2. Massage the tired muscles	44	44	53	..	..
3. Take further exercise to "work off" the fatigue toxins	6	5	5	..	..
*4. Sleep it off	31	32	29	..	..
Unanswered	..	3	..	..	..
98. WHAT IS THE BEST THING FOR A PERSON TO DO WHO FEELS THAT HE IS ABOUT TO FAINT?					
1. Move to fresh air	39	35	31	..	..
2. Drink some cold water	7	9	4	..	..
*3. Lower the head between the knees	51	49	61	..	..
4. Have someone rub his forehead with a rotary motion	2	3	4	..	..
Unanswered	1	4	..	..	..
99. WHICH ONE OF THESE FACTORS CONTRIBUTES MOST TO AUTOMOBILE ACCIDENTS?					
1. Road conditions	2	3	..	..	..
2. Weather	3	4	6	..	..
*3. Human element	73	74	79	..	..
4. Defects of car	21	16	15	..	..
Unanswered	1	3	..	..	..

	H.S.S. %	C.F. %	Ad'lts %		
100. WHEN BOYS AND GIRLS BEGIN TO THINK ABOUT "PETTING" THE PARENTS SHOULD:					
1. Warn them about the immorality of it..	7	12	4	..	..
2. Forbid them to meet individuals of the opposite sex	1	1	4	..	..
*3. Encourage meeting of friends under good surroundings such as the home.....	90	81	92	..	..
4. Let them go ahead so as to keep up with their own group of acquaintances.....	2	1	..	..	..
Unanswered	..	5	..	..	..

The following conclusions are based upon an analysis of the one hundred individual questions:

1. The ranking of questions based upon the percentage of correct answers is about the same for high school seniors, college freshmen, and adults when all individuals in each group are included.

2. In certain classes some questions score very high, others very low, indicating stress in teaching or other source of information, or absence of such information.

3. Some high school classes scored much higher on certain questions than the college freshmen. These questions usually dealt with more factual topics. The college freshmen and the adults usually rated higher on the more general questions.

4. It is evident that even intelligent, educated people hold many health misconceptions and health superstitions.

5. It is difficult to say in which field of health education people are best informed. One should not generalize too quickly from these questions in that respect for the reason that the questions in separate fields are not necessarily of equal difficulty. However, the extent to which people are informed on each individual question is evident from the figures shown.

ANALYSIS OF SELECTED QUESTIONS

An analysis of selected questions gives the following information:

No. 4. In one senior high school class 26 per cent of the members thought that chiropractors were best qualified to examine the eyes. Less than 1 per cent of all other groups checked that answer.

No. 11. High school and college students know the correct position for artificial respiration, some high school classes scoring 100 per cent. Adults are less well-informed. In one college freshman class it was found that the majority of the students who did not know the correct answer had never been boy or girl scouts.

No. 16. The value of the ultra-violet rays in the treatment of rickets is understood by 94 per cent of the adults as compared to only 61 per cent of the high school seniors and 79 per cent of the college freshmen.

The adults probably have had more actual experience with this topic in connection with their own children.

No. 23. It is amusing to note that 9 to 16 per cent believe that parents should develop in their sons the attitude "that girls are something biologically necessary for the life of the race."

No. 25. The physiological reason for 68 degrees being the desirable indoor temperature is known by 84 per cent of all groups.

No. 26. A marked increase between the spring and fall returns is noted in the number of correct answers to this question which deals with "the best methods of reducing death from cancer." It possibly indicates the effect of the increased publicity on this subject in the past year. The same situation also applies to No. 74 which deals with the frequency rate of the venereal diseases for various age groups.

No. 36. Only 48 per cent of the high school seniors, 59 per cent of the college freshmen and 73 per cent of the adults indicate that medical doctors are better than chiropractors. Actually 6, 7, and 2 per cent respectively of these groups state that the medical doctor is inferior.

Nos. 39 and 66. The returns on these two questions which deal with tobacco smoke and illuminating gas indicate that many people do not understand the difference between carbon dioxide and carbon monoxide gases. A large percentage believe that it is carbon dioxide rather than carbon monoxide which is dangerous.

No. 47. Exactly the same percentage (91 per cent) of each group know that the promotion of free bleeding is the best procedure in the case of a snake bite.

No. 52. Only 68 per cent indicated that oxygen is carried by the red corpuscles although in No. 77, 69 to 95 per cent of each group indicated that "anemia is a disease in which the individual does not have sufficient red corpuscles."

No. 60. Less than half of each group know the main physiological function of perspiring.

No. 64. That the "dangers of venereal diseases should be explained to children during adolescence as part of sex instruction" is checked by an average of 64 per cent of all those tested.

No. 74. That the venereal diseases are most frequently contracted between the ages of 19 and 24 years is known by 52 per cent of the high school students, 43 per cent of the college freshmen, and 72 per cent of the adults. It is evident that the two school groups need more enlightenment on this point.

No. 78. That malaria is spread by mosquitoes is known by over 95 per cent of each group.

No. 96. Only one-third of those tested realize that the lower death rate of today is due to the prevention of infant deaths rather than the prevention of adult deaths.

Nos. 38, 68, 71, and 86 deal with tuberculosis. Less than half of each group indicated that tuberculosis was "an infection." Over half of all individuals considered the most important procedure in the recovery from tuberculosis to be "to move to a dry climate." About 20 per cent believe that tuberculosis can be inherited. Most people believe that tuberculosis is acquired most frequently by "drinking milk from infected cows" rather than from "contact with adults who have the disease." This last answer is significant when one understands that practically all milk sold in the cities included in the survey is pasteurized.

NUTRITION

No. 2. It is evident from this question that more education is needed in the values of foods. Only 31 per cent of the high school seniors, 53 per cent of college freshmen, and 70 per cent of adults knew that cheese was the best substitute for meat of the foods listed in the question.

No. 18. That spinach is rich in iron is known by 93 per cent of all groups.

No. 28. That cooking decreases the value of vitamins is known by 39 per cent of the high school seniors, 47 per cent of the college freshmen, and 70 per cent of the adults.

No. 34. That sugar is used for energy is known by 65 per cent of all groups.

No. 42. That milk lacks roughage rather than other food essentials is known by 75 per cent of the individuals tested.

No. 48. The caloric needs of high school boys are understood by less than half of each group.

SUPERSTITIONS

No. 3. That night air is harmful is stated by 3 per cent of all groups.

No. 6. To the question "Can goiter be prevented by wearing amber beads around the neck?" only 78 per cent definitely state that "it is of no value."

No. 19. To the question "Can a prospective mother make her child more musical if she listens to good music?" only 60 per cent definitely state that "it is contrary to the facts of heredity to expect this." The others believe this statement entirely or in part.

No. 27. To the question "Is it true that leaving rubbers on the feet indoors too long may cause eye trouble?" 29 per cent of the high school seniors and college freshmen and 13 per cent of the adults answer that it is true or state that there are some known instances of this happening.

No. 35. That "the souring of milk is hastened" by "thunderstorms" rather than by "poor refrigeration" is believed by 2 per cent of the high school seniors, 6 per cent of the college freshmen, and 9 per cent of the adults.

No. 54. An average of 85 per cent of all three groups know that "the Federal Food and Drug Act" prohibits only "false advertising on the package".

No. 61. That "various marks of disfiguration on the newborn child are due to fright of the mother during pregnancy," is believed by 41 per cent of the high school seniors, 29 per cent of the college freshmen, and 38 per cent of the adults.

No. 67. This question was included in order to determine to some extent the attitude toward health advertising over the radio. The results show that 73 per cent of the high school seniors, 71 per cent of the college freshmen, and 55 per cent of the adults consider that "it is of questionable reliability." The others believe that it is either "very reliable" or that "most of it is reliable."

No. 70. An average of 74 per cent of all groups do not believe that "fish is a brain food." The others either believe this statement or are not sure whether it is correct.

No. 71. Almost 50 per cent of all groups believe that communicable diseases can be inherited and one-third of these believe that "tuberculosis is one of the two or three diseases which may be inherited."

No. 73. In regard to the question "Can rheumatism be cured by the application of rattlesnake oil?" we find that 22 per cent of the high school seniors, 19 per cent of the college freshmen, and 14 per cent of the adults hold this belief.

No. 76. That toads cause warts is believed by 22 per cent of the high school seniors and college freshmen and by 16 per cent of the adults.

No. 85. That raw meat will reduce a swelling or a "black eye" due to a bruise is believed by 40 per cent of the high school seniors, 36 per cent of the college freshmen, and 20 per cent of the adults, and over half of these individuals state that "the meat must be beef steak."

No. 92. An average of 68 per cent of all groups believe that "toasted as compared with untoasted tobacco in cigarettes" is "about as harmful." Most of the others state either that it is "less harmful" or "of no harm."

RECOMMENDATIONS

The following recommendations are based upon the findings of this investigation: (1) that further study be made along these lines; (2) that health education be given a more important place in the schools than it usually has at present; and (3) that other subjects be analyzed to determine whether they are contributing to the extent that can reasonably be expected.

Textbook Fallacies Regarding the Development of the Child's Heart

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AN EVER-INCREASING death rate from heart disease causes great concern on the part of physicians and physical educators. Although a large number of heart disease cases are caused by various infections, hypertension is responsible for 26 per cent of the cases (New England). Hypertension depends upon a disturbance of the cardio-vascular apparatus, the origin of which is obscure. Yet it is permissible to suppose that present day living with frequent emotional displays may in a measure be responsible for some of these cases. At any rate, there is a general agreement that it is a predisposing and an aggravating factor. This immediately raises a question of prophylaxis. Since one-half to one per cent of all school children of the northern parts of this country suffer from heart disease, prophylactic measures should obviously start early in life.

In connection with this it is worth while to remember what Cabot expressed so emphatically: "Most 'heart disease' is imaginary."[1] On one occasion, of eighteen men sent to him by physicians, fourteen were sound. He also states that "myocarditis was recognized six times as often as it was present; valvular disease twice as often."

A fear of possible injury to the heart often leads to an illogical prohibition of "all" physical activities. Usually this prohibition affects only the few hours a week of exercise in schools. The intensity of play and games outside of the school is not controlled. There is no doubt that a heart weakened by some disease may be injured by unsuitable exertion, but if the heart be sound, according to observations made by the leading German sport physicians, the danger is remote if possible at all. (Herxheimer.[2]) So far it has been difficult to establish clear cut cases of heart injuries due exclusively to exercise. Many of the alleged cases were preceded by some illness which affected the heart.

In spite of these facts, an exaggerated fear still persists. Of special interest is the idea that the heart is especially vulnerable in childhood due to a "natural disharmony" between the development of the heart and the large blood vessels. This idea has persisted for almost two generations and may be found in leading textbooks on this subject. The

A paper presented before the Therapeutics Section of the American Physical Education Association Convention, April 23, 1937, New York City.

[1] Indices refer to Bibliography at the end of this article.

purpose of this article is to trace the origin of this idea and to prove its fallacy.

More than fifty years ago, Beneke pointed out an apparent discrepancy between the growth of the heart and the aorta, and the pulmonary artery.[3] Whereas the volume of the heart increases in proportion to the body weight, the circumference of the aorta and the pulmonary artery increases in proportion to the body length. This observation immediately made a great impression on the contemporary biologist-educators and was interpreted as anatomical lag indicating the inadequacy of the vasculatory system. Lesshaft, using data collected by Beneke, Quetelet and his own pupils, came to the same conclusion.[4] Later he used this as a reason for many anatomical and physiological changes.[5]

F. Schmidt in his book "Unser Körper," which served as the bible of physical education and influenced people throughout the entire civilized world, also stressed this observation, raising it to the status of a law governing the principles of physical education.[6] As late as 1931, a translation of a text, written by him in collaboration with Kohlrausch was published in this country. We read there ". . . the heart of an adult man is three times the size of the child's, while the proportionate circumference of the aorta (close to the heart) remains the same. . . . We can readily see that no system of exercise can meet the first principles of practical hygiene, unless it recognizes the physiological condition described."[7]

E. Young emphasized the significance of the changes at a particular age.[8] "At this age [seven years] the heart, which has been relatively larger than the blood vessels, begins to be relatively smaller, and this factor with others mentioned diminishes the child's vigor at this period."

These statements imply that there is a natural discrepancy in development between the heart and blood vessels which becomes noticeable at the age of seven and continues to grow worse with age, thus creating conditions favorable to hypertension. If this quasi-fact is not recognized harm is done to growing children.

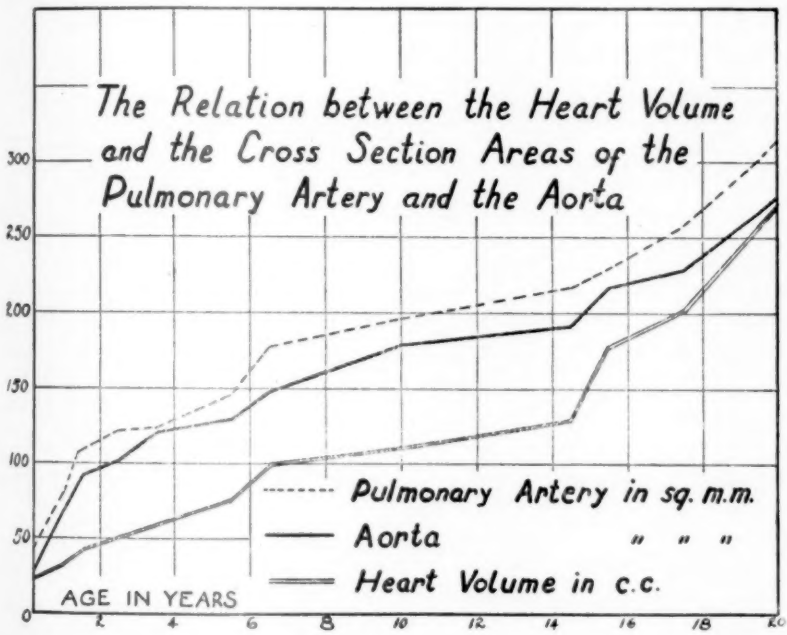
These implications are of far-reaching importance and explain why Beneke's interpretations either in the original form or with some modifications have been used over and over in books dealing with the child's heart.

Beneke's observation is essentially correct, but interpretations made by him and by others are misleading. Instead of being helpful they have created imaginary dangers. Fortunately it is easy to show the obvious fallacy of these interpretations.

In the first place, it is impossible to expect a perfect proportionality between a three-dimensional volume and a one-dimensional circumference. In the second place, it is known from hydro-mechanics that in the estimation of the efficiency of the outlets of a pump, the area of the

cross section rather than the circumference should be taken into consideration, because the volume of a fluid passing through an opening is equal to the product of velocity of the flow by the area of the cross section of the opening. Somehow this principle escaped the attention of even such a careful investigator as Lesshaft. Thoma[9] came close to exposing the fallacy and then Dreyer, Ray, and Walker[10] pointed out a correlation between the cross section of the aorta and body surface, yet the relation between the heart volume and the cross section of the aorta escaped their attention.

The present writer used the original data collected by Beneke and from this data calculated the cross section areas of the aorta and the pulmonary artery (Table I). Their relation to the heart volume is shown on Figure I.



It is seen that the development of the aorta and the pulmonary artery follows closely the development of the heart. This closeness is remarkable, especially if we remember that Beneke measured the volume of the heart tissue and not the heart capacity.

In the light of this finding, the statements made by Schmidt and Kohlrausch become unsupported, and a physical director may now pursue his work without being troubled by the impressive warning which has been difficult to follow in practice and impossible to correlate with the observations on children engaged in informal games. As to the

reasons for increasing blood pressure and "many organic changes" as suggested by Lesshaft, physiologists will have to find other, better causes.

As to the statement found in the article by E. Young that the heart is relatively smaller at the age of seven, it may be seen from Table II (as well as Figure I) that this is not true. After the end of the first year the ratio of the heart volume to the aortic cross section steadily increases. The same is true with regard to the pulmonary artery.

This does away with one more unfounded cause of fear. Conclusions:

1. Contrary to an established notion, there is no discrepancy between the development of the heart and the cross section of the largest arteries.

2. The heart volume and the cross section areas of the aorta and

TABLE I

THE HEART VOLUME AND THE CROSS SECTION AREAS OF THE PULMONARY ARTERY AND THE AORTA

Age	Heart Volume	Cross Section Areas (in sq. cm.)	
		Pulmon. Artery	Aorta
Birth	22.3	44.7	27.8
1 year	33.6	82.5	71.5
2 years	44.3	107.1	91.4
3 years	50.2	120.4	100.8
4 years	60.0	124.0	120.9
6 years	75.1	145.0	129.2
7 years	99.0	176.4	147.1
9–11 years	111.5	195.5	178.0
15 years	130.0	216.7	191.0
16 years	177.3	229.4	215.0
18 years	202.4	257.5	227.6
20 years	259.7	300.9	265.8

Areas were calculated from Beneke's data

TABLE II

RATIO BETWEEN THE HEART VOLUME AND THE AREAS OF CROSS SECTION OF THE PULMONARY ARTERY AND THE AORTA

Age	Heart/Pulm. Art.	Heart/Aorta
Birth	0.50	0.71
1 year	0.40	0.47
2 years	0.41	0.47
3 years	0.42	0.50
4 years	0.48	0.50
6 years	0.52	0.58
7 years	0.56	0.67
9–11 years	0.57	0.63
15 years	0.60	0.68
16 years	0.77	0.80
18 years	0.78	0.89
20 years	0.86	0.98

the pulmonary artery show a close proportionality. It would be of interest to use the heart capacity instead of the volume, but unfortunately there are not enough data available.

3. The ratio of the heart volume to the size of the blood vessel is not decreased at the age of seven. There is a steady gradual increase in this ratio which starts at the end of the first year.

4. Hygienic warnings based upon erroneous interpretations should be discarded.

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A Comparative Study of Undergraduate Women Majors and Non-Majors in Physical Education with Respect to Certain Personal Traits

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STATEMENT OF THE PROBLEM

THIS study undertakes a comparison of two hundred undergraduate women physical education majors and two hundred non-majors with respect to certain familial relationships and five personal traits: interests, general information, intelligence, motor ability, and personality.

PURPOSE OF THE STUDY

The purpose of this study is to determine what type of young women is entering the profession of physical education today as compared with those entering other fields of specialization. Specifically, it seeks the answers to the following questions:

1. Can undergraduate women majors in physical education be distinguished from non-majors upon the basis of expressed preferences which indicate a differential pattern of interests?

2. Are undergraduate women majors in physical education better or less well informed than non-majors, or equally so, with respect to current activities, fine arts, literature, history, science, and sports?

3. Are undergraduate women majors in physical education more or less intelligent than non-majors or equally so?

4. Are undergraduate women majors in physical education endowed with more or less motor ability than non-majors or with an equal amount?

5. Do undergraduate women majors in physical education conform to certain personality types—that is, are they more or less stable than non-majors, more or less extroverted, more or less self-sufficient and dominating?

These five personal traits were chosen for investigation from a longer preliminary list because they are traits which can be measured objectively and analyzed statistically, and which figure promi-

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Digest of a dissertation published by the Bureau of Publications, Teachers College, Columbia University, 1936.

nently in hypothetical comparisons of the physical education major and the non-major.

The term *personal traits* is used in the sense of qualities which tend to characterize the individual as such. The investigator is fully aware of the influence of many significant factors conditioning the expression of these so-called traits. The use of the term, therefore, is not based upon an erroneous conception of traits in the sense of fixed entities.

SOURCES AND TREATMENT OF DATA

The data were collected from three widely distributed state universities with four-year major programs in physical education. The following instruments were employed:

1. An original Interest Questionnaire.
2. An original General Information Test.
3. The Otis S-A Test of Mental Ability, Higher Examination, Form D.
4. The Brace Scale of Motor Ability and the Jump and Reach Test.
5. The Bernreuter Personality Inventory.

For the development of the original tests, preliminary studies were conducted among unselected groups of graduate students (majors and non-majors in physical education) at Columbia University. The final scoring key for the Interest Questionnaire was based upon the average weighted responses of two different graduate groups.[1] The Interest Questionnaire is made up of 312 items opposite which an individual may check "Like," "Indifferent," or "Dislike." The items are classified under (1) Recreations and Amusements, (2) Extra-Curricular Activities, (3) Characteristics of Work, (4) Literary Preferences, (5) Characteristics of People, (6) School Subjects, (7) Prominent Women. An average reliability coefficient of .90 was found between the odd and even items of the Interest Questionnaire.

The General Information Test consists of 6 sections sampling the fields of fine arts, literature, history and civics, science and education, sports, and miscellaneous facts of current activities. The 45 items in each section are framed as statements with four alternative answers. The test was first submitted to a graduate group of majors and non-majors. Upon the basis of their responses, the items of each section were arranged in order of difficulty. A reliability coefficient of .94 was found between the odd and even items of the test.

The various tests were administered to all undergraduate women majors in the three universities, and to comparable groups of non-majors selected upon bases to yield a random sampling of non-major stu-

[1] The pattern used for the weighting of each item may be expressed thus: $w = \frac{Pm - Pnm}{\sigma D}$ where w is the weight assigned, expressed at the nearest whole number, Pm and Pnm are the percentages of response of majors and non-majors, respectively, and σ D is the standard error of the difference in response.

dents. Papers were scored and tabulations were made according to the total major and non-major groups, and according to the major and non-major groups in each of the three universities, designated as *A*, *B*, and *C*, respectively. Comparisons were made in terms of the biserial *r* between the total scores of the two groups, and in terms of differences between their percentages of response and between their mean scores on the given tests. Differences between the means of majors' and non-majors' various traits were interpreted as significant when these differences, divided by the standard error of the difference, yielded a quotient of 3 or more.

FINDINGS

1. Personal Data. — No significant differences were disclosed between the mean ages of the majors and non-majors at each class level. The largest percentage of both groups were found to minor in English. The majors were distinguished from the non-majors by their choice of minor subjects among the biological sciences while more non-majors chose to minor in modern languages. Another significant difference lay in the non-majors' failure to have chosen a minor subject at the time the study was undertaken. The comparison of the occupational status of the fathers of the two groups disclosed no significant differences which were, at the same time, based upon percentages large enough to be meaningful. No significant differences were found with reference to the employment of mothers of the two groups nor to the number of brothers and sisters reported in each family.

2. The Interest Questionnaire.—The Interest Questionnaire revealed marked differences between these undergraduate major and non-major groups. It disclosed consistent, differential patterns of interests allied with work, play, and social relationships. The majors were found to differ most from the non-majors in their preference for exciting, vigorous, competitive, outdoor activities both in work and in play, while the non-majors preferred activities of a quieter, slower, non-competitive, and indoor nature. These discriminative tastes were further reflected in their reactions to characteristics of people and to the list of prominent women included in the questionnaire. In reacting to items listed under extra-curricular activities, magazines, and school subjects, the majors differed in preferences primarily associated with their field of professional interest plus a few magazines of a light, popular nature. The non-majors differed in their preferences for activities sponsored by language clubs, literary and Greek letter societies—tastes repeated in their choice of literature among preferred school subjects with modern languages just short of statistical significance. Their preferred magazines were either associated with the home or somewhat aesthetic in their appeal. No significant differences were found between ten types of books listed.

3. The General Information Test.—The non-majors, as a group,

were found to be better informed than the majors on those sections of the test related to miscellaneous current activities, fine arts, literature, and history and civics, whereas the majors were better informed with respect to information sampled in the sections on science and education, and sports. All differences were not statistically significant; the most marked superiority for the majors lay in the field of sports in Universities *B* and *C*. Only in University *B* were the non-major superiorities statistically significant.

4. The Intelligence Test. — When the total groups of majors and non-majors were compared on the basis of the results of the Otis Self-Administering Test of Mental Ability, Higher Examination, Form D, both the biserial *r* of $-.25 \pm .04$ and the significant difference of -4.06 between their mean scores denote intellectual superiority on the part of the non-majors. When the two groups are studied in each separate university, however, the difference between their mean scores retained statistical significance in only one of the three institutions. We may conclude, therefore, that the non-majors in University *B* are significantly superior in intelligence, as measured by the Otis Test, whereas the mean scores of majors and non-majors in Universities *A* and *C* are practically identical.

5. The Motor Ability Tests.—On both the Brace Scale and the Jump and Reach Test, the physical education majors displayed superior motor ability as measured by these two instruments. On the Brace Scale, differences between the mean scores of the two groups were entirely sig-

TABLE I

COMPARISON IN TERMS OF BISERIAL *r* AND MEAN SCORES ON GIVEN TESTS ADMINISTERED TO 200 UNDERGRADUATE WOMEN PHYSICAL EDUCATION MAJORS AND 200 NON-MAJORS

Test	Biserial *r*	Majors N = 200		Non-Majors N = 200		$DM_1 - M_2$ / σD
		Mean	S.D.	Mean	S.D.	
Interest	$.84 \pm .02$	99.0	41.57	20.1	45.29	18.15
Gen. Information (Sec. 6)	$.66 \pm .03$	26.4	6.65	19.1	5.54	11.95
Brace Motor Ability	$.53 \pm .03$	12.7	2.69	10.3	2.54	9.33
Jump and Reach	$.47 \pm .03$	14.6	2.50	12.6	2.31	8.15
Personality (B_3-I)	$-.25 \pm .04$	−33.4	45.11	−14.4	47.33	−4.11
Intelligence (Form D)	$-.25 \pm .04$	41.9	8.44	45.4	8.83	−4.06
Personality (B_1-N)	$-.24 \pm .04$	−55.2	74.10	−25.5	78.58	−3.89
Personality (B_4-D)	$.23 \pm .04$	45.5	56.80	23.6	60.04	3.75
Gen. Information (Sec. 2)	$-.23 \pm .04$	21.0	5.50	23.2	6.39	−3.67
(Sec. 3)	$-.19 \pm .04$	23.0	6.24	25.0	6.92	−3.04
(Sec. 4)	$-.12 \pm .04$	27.4	5.35	28.5	5.95	−1.96
Personality (B_2-S)	$.11 \pm .04$	6.3	52.88	−3.4	53.24	1.83
Gen. Information (Sec. 1)	$-.11 \pm .04$	26.8	5.14	27.8	5.08	−1.82
(Sec. 5)	$.03 \pm .04$	28.2	4.53	28.0	4.96	.42
(Total)	$.02 \pm .04$	152.9	25.88	151.9	26.73	.36

TABLE II

COMPARISON OF MEAN SCORES OF UNDERGRADUATE WOMEN PHYSICAL EDUCATION MAJORS AND NON-MAJORS ON GIVEN TESTS IN EACH OF THREE STATE UNIVERSITIES

Test	University	Majors		Non-Majors		$D_{M_1-M_2}$
		Mean	S.D.	Mean	S.D.	σD
Interest	A.....	96.5	42.72	12.2	43.59	12.67
	B.....	97.0	39.21	15.0	47.96	10.84
	C.....	107.1	34.73	37.2	40.64	9.14
Jump and Reach	A.....	15.7	2.07	12.7	2.21	9.37
	B.....	13.8	2.15	12.9	2.31	2.32
	C.....	13.4	2.68	12.0	2.35	2.68
Brace Motor Ability	A.....	13.5	2.42	10.7	2.73	7.09
	B.....	12.6	2.64	10.2	2.21	5.78
	C.....	11.5	2.76	9.8	2.58	3.13
Personality (B_1-N—neurotic tendency)	A.....	—75.7	69.38	—28.5	81.68	—4.03
	B.....	—27.3	74.40	—28.8	68.02	.11
	C.....	—54.5	69.62	—12.2	81.92	—2.75
Personality (B_2-I—introversion—extroversion)	A.....	—45.0	40.76	—18.2	50.91	—3.76
	B.....	—12.4	44.96	—15.2	40.47	.38
	C.....	—39.0	43.47	—6.9	49.55	—3.41
Personality (B_4-D—dominance—submission)	A.....	54.3	57.28	21.6	61.86	3.55
	B.....	41.7	55.92	28.1	59.02	1.37
	C.....	34.7	54.66	20.3	58.02	1.26
General Information (Total)	A.....	166.1	24.58	156.2	23.40	2.67
	B.....	139.8	22.55	151.3	29.54	—2.53
	C.....	145.7	20.36	145.5	26.31	.03
General Information (Sec. 2—fine arts)	A.....	23.2	5.76	25.0	5.99	—1.94
	B.....	17.2	4.36	21.7	6.68	—4.70
	C.....	20.6	4.56	22.2	5.84	—1.56
Personality (B_2-S—self-sufficiency)	A.....	11.3	51.22	—3.6	51.62	1.88
	B.....	7.6	59.20	3.3	53.44	.43
	C.....	—.1	47.02	—12.2	54.28	1.17
General Information (Sec. 6—sports)	A.....	29.8	5.85	28.7	5.50	1.26
	B.....	23.1	5.66	19.1	5.75	4.07
	C.....	24.7	6.30	18.8	5.13	5.05
General Information (Sec. 5—science and education)	A.....	29.4	4.12	28.7	4.45	1.15
	B.....	26.5	4.83	27.8	5.44	—1.42
	C.....	28.3	4.10	27.4	4.91	1.01
Intelligence (Form D)	A.....	44.9	7.92	46.1	8.32	—.91
	B.....	39.8	8.23	47.3	9.62	—4.85
	C.....	39.2	7.83	39.9	7.45	—.45
General Information (Sec. 1—miscellaneous)	A.....	29.2	5.03	28.5	4.82	.90
	B.....	24.1	4.75	27.3	5.62	—3.65
	C.....	26.1	3.85	27.1	4.47	—1.12
General Information (Sec. 4—history and civics)	A.....	29.6	4.68	29.0	5.43	.76
	B.....	25.6	5.44	29.1	5.97	—3.53
	C.....	25.7	4.88	26.8	6.54	—.90
General Information (Sec. 3—literature)	A.....	24.7	6.52	25.0	6.66	—.32
	B.....	22.5	5.46	26.2	6.97	—3.43
	C.....	20.5	5.68	22.9	6.86	—1.91

Minus signs are indicative of the possession of the given traits in larger amounts on the part of the non-major group.

nificant in the three universities; differences between their mean scores on the Jump and Reach Test were of marked significance in University *A* and were probably significant in Universities *B* and *C*.

6. The Personality Test.—The Bernreuter Personality Inventory indicated that the majors, as a group, were less neurotic than the non-majors, more extroverted, and more dominant. There was a greater overlapping of scores on the scale for self-sufficiency so that the majors' superiority on this scale lacked statistical significance. The differences in neurotic tendency were marked in University *A* and were very probably significant in University *C*; the non-majors were slightly more stable than the majors in University *B*, however. The non-majors in University *B* were also slightly more extroverted than the majors whereas the majors in Universities *A* and *C* showed marked superiority in this trait. The superiority in dominance on the part of the majors was statistically significant in University *A* only. A correlation coefficient of .96±.00 found between the total scores of majors and non-majors on B1-N (Neurotic Tendency) and B3-I (Introversion), denotes a decided community with reference to these two keys. A correlation coefficient of .60±.03 found between total scores on B2-S (Self-sufficiency) and B4-D (Dominance), sugests some relationship between the keys measuring these two traits.

CONCLUSIONS

The educational implications of the results of this investigation are particularly significant with respect to the selection of women students who wish to major in the field of physical education, and to emphases in the program of studies making up the major curriculum. Its results offer a means of ascertaining the degree of correspondence existent between the theories voiced in the literature relative to certain desirable qualifications of the personnel in physical education, and the actual possession of these qualifications on the part of those enrolled in departments of professional preparation. In other words, the investigation affords a means of estimating correspondence or discrepancies between theory and practice with respect to the specific personal traits studied.

An interest in physical education appears in many lists of standards for student selection. The Interest Questionnaire developed in the study is recommended, therefore, as one instrument to be employed in vocational guidance and student selection. The author cautions against any arbitrary interpretation of scores on the Interest Questionnaire, however; it must be remembered that a preference for the courses and activities of the physical education curriculum is no guarantee of success in that field; on the other hand, it seems reasonable to believe that success, other things being equal, is more likely to accrue from engagement in activities which are liked by the individual than in activities which are disliked by her. That ability should augment interest is probably a sound assumption, also. An evaluation of other factors, therefore, should

supplement the use of the Interest Questionnaire for guidance and selective purposes.

There is a great deal of argument for the selection of physical educators whose cultural background is broader than that which at one time tended to characterize the personnel in this field. Educational emphasis upon the total organism precludes the student's dissection with allocation of different phases of his development to sharply demarcated departmental units. If the teacher of physical education, therefore, is to make her richest contribution to the individual's all-round development, she must epitomize a point of view which goes beyond interest in, and acquaintance with, motor techniques, just as the teacher of literature or fine arts should take them into account. The superiorities pointed out with reference to the results of the General Information Test would seem to indicate, however, a broader, more cultural background, as measured by this test, on the part of the non-majors who participated in the investigation, and a narrower, more technical background on the part of the major group. Whether this is desirable or undesirable is a question to be resolved by those in charge of professional preparation. The problem may be met through selection standards by administering to candidates a test sampling the various areas of information; or it may be met by enriching the major course of study so that students have a greater opportunity to become acquainted with areas of information outside their major field. That the non-majors of this group in Universities *B* and *C* were so poorly informed in knowledge of sports and games is as disparaging, from a broad, cultural point of view, as the majors' shortcomings in areas in which the non-major group excelled.

Relatively high native intelligence is another attribute to be manifested by the potential teacher of physical education according to various lists of selection standards. The results of this study revealed a discrepancy between theory and practice with respect to the factor of intelligence. That the disparity is marked in one of the three universities suggests the advisability of a more careful evaluation of this factor if intelligence is considered a desirable qualification.

Because the teacher of physical education is called upon frequently to demonstrate her own skills, some measure of motor educability is necessary in student selection. While the relationship between skill in an activity and ability to teach that activity has not been scientifically established, the investigator feels that the teacher-training institution should aim to develop teachers with adequate skills for purposes of example and demonstration; whether this is possible is dependent upon an evaluation of the potential teacher's possession of a sufficient degree of motor educability. The results of the Brace Scale and Jump and Reach Test warrant their use in student selection until a more valid measure of motor educability is developed.

There is need for the development of a scale which will measure more

adequately qualities of leadership, social ability, and other personality traits deemed desirable for physical educators. Such a scale might evolve from a definitive analysis of the essential traits and from continued experimentation with the Bernreuter and Flanagan keys. Either B_1-N or B_3-I of the Bernreuter Scales might be used for the measurement of emotional stability in terms of neurotic tendency and extroversion-introversion. It is questionable whether extroversion—to the exclusion of all manifestations of introversion—should be extolled as a quality of physical educators. It would appear that the most effective teacher would possess that degree of introversion which would enable her to think creatively, and to plan with vision, plus that degree of extroversion which would enable her to execute efficiently.

An Analytical Study of the Stunt Type Test as a Measure of Motor Educability

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IN 1927 Brace published his pioneer work on measuring motor ability. Brace followed somewhat the pattern of the Binet intelligence test procedure and in formulating his test used stunts which in varying degrees required agility, balance, control, flexibility, and strength. He began with thirty carefully selected stunts which were later reduced to twenty. The individuals tested were given only one trial at each stunt. The total scores were T-scored in order to give an easily understandable basis of comparison. Data for boys and girls were treated together, and no age or sex adaptations were made, except for college women. This test, devised in the early days of physical education testing, had much influence on the testing movement, and Dr. Brace deserves much credit not only for the very excellent test itself, but for the technique of test building introduced.

Since the publication of the Brace test a number of excellent tests have been developed which specifically measure a number of the items emphasized by Brace, such as agility, balance, and strength. It was felt, therefore, that it might be possible to utilize the stunt type of test to measure *motor educability* or ability to learn new skills somewhat more narrowly than had been planned by Brace. It was further hoped to subject the individual stunts comprising the test to a more rigorous statistical examination than was feasible at the time Dr. Brace conducted his study. It was also hoped that the length of the test might be reduced and that separate groups of stunts might be planned for the two sexes and for different age groups. Since this study was completed (1932) better techniques for validating tests of motor educability have been devised and a number of studies conducted. Since this test has been worked out and standards reported, however, it is felt that it is worth while presenting it at some length.

PRELIMINARY STUDY

To reduce the statistical labor a small preliminary study was first conducted on forty-two junior and senior high school boys. Thirty-nine stunts were selected from the numerous ones proposed in the various stunt books and these included all of the stunts used by Brace. The total number of the thirty-nine stunts successfully passed by each boy was

used as a criterion score for this preliminary study and the success or failure upon the first trial for each stunt was correlated against this criterion, using bi-serial correlations.

The bi-serial correlation assumes that the abilities measured by each stunt are normally distributed. Since the total range of the junior and senior high school was used in this study, this assumption is probably not justified. This, however, would simply raise the correlation slightly, while the *comparative* size of the correlations would be approximately the same. Actually, evidence is available which indicates that the departure from normality is slight indeed.[1]

The range of the correlations with the exception of one test ran from .11 to .87. The one exception was a test in which all but one boy passed the test. Since he was one whose scores otherwise were good, a negative correlation was obtained. The distribution of these correlations is seen in Table I. Six of the original Brace tests were below .3, though for the most part these were easy tests and would probably have shown better correlations with younger boys or with girls.[2]

The twenty-four tests giving the highest correlations were selected for further study. The bi-serial correlations of these tests ran from .38

TABLE I

DISTRIBUTION OF BI-SERIAL CORRELATIONS OF INDIVIDUAL STUNTS WITH THE TOTAL STUNT SCORE

Correlation	Frequencies	Frequencies of Original Brace Stunts
.85	1	
.80		
.75		
.70	4	3
.65	3	1
.60	8	3
.55	1	
.50	1	1
.45	3	2
.40	4	2
.35	3	1
.30	1	1
.25	3	2
.20	2	1
.15		
.10	3	2
.05		
.00	1	1

[1] Evidence of this fact may be seen in the very low correlations found between stunts and age. The correlations of the whole stunt test and age was .1479 for girls and .4229 for boys, for ages 9 to 19.

[2] There is other evidence, as yet unreported, which indicates that muscular strength, or the lack of it, conditions the success of girls in these stunts much more than boys. Most boys have the minimum of strength necessary to the successful accomplishment of the tests used in this battery, though not for some of the strength tests of the original Brace battery.

to .87, with the large majority being bunched between .6 and .74. Data were then collected for these twenty-four tests upon 335 boys and 424 girls from the Des Moines public schools. These ran from grades four to twelve, inclusive. Two trials were given on each stunt.

ANALYSIS OF THE DATA

The first step in the analysis was to study by ages the distribution of the percentages of each test passed by each age group. Obviously, a test passed by a much larger number of thirteen-year olds than fifteen-year olds would not be a good test. The change in percentages passed by ages was sufficiently small that we felt justified in grouping the children by grades. Hence, three groupings were made: Grades four to six, inclusive; junior high school; and senior high school. The tests were analyzed in these three groups for each sex in all of the aspects of the study reported below.

The next step in the study was to correlate each stunt by bi-serial correlation with the Sargent jump, chinning strength, total points for four track and field events, and classification index for boys and chronological age for girls. The stunts were correlated both for first trial alone and for success or failure on first and second trials together. Since an attempt was to be made to develop a test primarily of motor educability, other things being equal, stunts would be chosen which had relatively *low* correlations with the Sargent jump, chinning strength, classification index, and age, thus indicating relatively low correlations with strength, size, maturity, and power.

The next step was to compute a partial correlation between each stunt with age held constant to the stunt and total points for track and field events with classification index, Sargent jump, and chinning strength held constant for boys, and age, Sargent jump, and chinning strength for girls. Using the sub-scripts:

0	stunt	3	classification index (boys)
1	age	4	Sargent jump
2	total points	5	chinning strength

the equation can be written as:

$$r_{(0\cdot1)(2\cdot345)} \text{ for boys and } r_{(0\cdot1)(2\cdot145)} \text{ for girls.}$$

This correlation needs comment as to its logic. It has been found in other studies that there is a very high correlation between track and field athletics, the Sargent Jump, arm strength, and the classification index (or age for girls). These variables will predict the total points in a fairly restricted age range to the extent of .75 in boys and about .65 in girls. It was felt that much of the difference between these correlations and unity was dependent upon differences in comparative skill, which would, in turn, be highly related to motor educability; for when the stunt score from the whole twenty-four tests was included in this formula, the mul-

tiple correlation rose to .86 in boys. Hence, it was felt that the partial correlation given above would be in effect correlating the part of total points not accounted for by size and maturity, power and strength, which should be largely skill or motor educability. Again the stunts were studied first trial alone and the combination of the two trials. The results were relatively low correlations when the individual stunts themselves were studied. These correlations will be found in Table II. The

TABLE II

CORRELATIONS OF STUNTS WITH TOTAL POINTS, WITH AGE HELD CONSTANT TO STUNT AND CLASSIFICATION INDEX (BOYS) OR AGE (GIRLS), SARGENT JUMP, AND ARM STRENGTH, HELD CONSTANT FOR TOTAL POINTS

Stunt	Boys			Girls		
	Elementary	Jr. H. S.	Sr. H. S.	Elementary	Jr. H. S.	Sr. H. S.
1	.159	.083	.421	.177	.593	—.091
2	.665	.862	.339	.065	.839	.207
3	.644	.743	.757	.161	.548	.483
4	.419	.319	—.062	.047	—.061	.126
5	.009	.105	.292	—.100	.278	.090
6	.139	.454	.278	.464	.558	.463
7	.229	.355	.232	.081	.268	.216
8	.264	.303	.206	.184	.636	.184
9	.134		.292	.344		.138
10	.304	.484		.602	.738	.564
11	.604	.226	.408	.205	.720	.262
12	.184	.376	.208	.124	.590	—.314
13	.441	.385	.115	.200	.598	.182
14	.382	.401	.490	.188	.524	.066
15	.181	.289	.285	.256	.705	.084
16	.753	.490	.758	.223	.648	.308
17	.604	.417	.232	—.028	.696	.268
18	.190	.202	.255	.277	.530	.258
19	.152	.371	.170	.235	.500	.461
20	.181	.248	.328	—.084	.696	.145
21	.124	.179	.353	.127	.382	.137
22	.076	.133	—.026	.022	.523	—.409
23	.203	.298	.222	.001	.363	.114
24	.085		.126	.492		.040

percentage of boys and girls passing each stunt, and the bi-serial correlations with the total number of stunts passed, are given in Table III.

The final selection of the test batteries for each age group was largely subjective, so much so that it hardly seems worth while to attempt to detail the process here. The relative lack of correlation with age, classification index, Sargent jump, and chin strength was taken into account, as was the size of the partial correlation described above. Each test was ranked according to these different items and, in general, the final selection was based upon the sum of the rankings. All stunts were then arranged graphically according to the percentage of individuals of that age group passing them. When there was a doubt as to which one

of two stunts should be chosen, the one was chosen which helped to make the most regular pattern from easy to difficult. One of the reasons why sets of stunts like these make good tests is that they include elements ranging from very easy to very difficult and this kind of selection alone will render the test reasonably valid.

The tests were finally arranged in six batteries as presented below. These batteries of ten stunts each were then correlated according to the partial correlation formula given above with total points. The results were as follow:

	Boys	Girls
Senior High Schools	.409	.390
Junior High Schools	.704	.698
Elementary Schools	.638	.138

TABLE III

PER CENT PASSED, AND BI-SERIAL CORRELATION WITH SUM OF STUNTS PASSED

	Boys (Ages 14–15)			Girls (Ages 11–12)		
Stunt	Per Cent Passed	r 1st Trial	r Both Trials	Per Cent Passed	r 1st Trial	r Both Trials
1	96	.2506	.1392	79	.4764	.4732
2	90	.4402	.4570	81	.6305	.5961
3	91	.4957	.3910	71	.4627	.4411
4	83	.4291	.3900	60	.5380	.4881
5	35	.6423	.5505	45	.5542	.5215
6	38	.8007	.6943	27	.4882	.4750
7	48	.5073	.4526	50	.5972	.5380
8	42	.6055	.4267	52	.6576	.6702
9	39	.3793	.3130	21	.3925	.3885
10	98	.2066	.5062	94	.1914	.1431
11	81	.4761	.4569	52	.6092	.5757
12	83	.5840	.5456	61	.7305	.7110
13	81	.5539	.5211	71	.3829	.3168
14	83	.6669	.7886	29	.7124	.6883
15	52	.5098	.5547	55	.6052	.5900
16	59	.4806	.4683	51	.7103	.7107
17	35	.6097	.5802	35	.7320	.7425
18	33	.4060	.3762	48	.5821	.5674
19	48	.4769	.4761	49	.6749	.6860
20	32	.2841	.3081	27	.5360	.5543
21	11	.3995	.4202	7	.4646	.5278
22	72	.4843	.4332	65	.7336	.7456
23	42	.6901	.6597	13	.6161	.5986
24	18	.4882	.4409	5	.3346	.3379

When one considers the nature of this partial correlation, with the exception of the elementary school girls, the size of the correlation is quite satisfactory. When the twenty best tests were given, very slightly larger correlations were obtained in some cases, and lower in others, indicating that on the average the batteries of ten tests were as effective as the larger batteries of twenty.

These batteries have been further studied as batteries by the factor

analysis technique. These studies soon will be reported in detail elsewhere. The correlations of this type of test with the unitary factor of motor educability, as distinct from speed, strength, and other factors, averaged about .53.

These test batteries seem to the writer to have a slight advantage over the original Brace test in that: first, they are calibrated to each sex and to different age groups; and second, that the time of administration is shortened by having to administer only ten tests instead of twenty.

There is evidence, both from this study and from subsequent studies done by others in the writer's laboratory which indicates that the scoring of two trials in each stunt gives a somewhat better correlation with motor educability than scoring one trial alone. As will be seen in the directions for administering and scoring the tests given below, they are scored by giving two points for success in the first trial and one point for success in the second trial when the first has been failed.

An experienced individual working for a number of years with one type of test gradually gains a number of impressions which would be difficult to prove directly by direct citations from the analyses of his data. These are "hunches" which may have to be studied farther. I should like to report my hunch regarding the stunt type of test. Since doing the study reported here I have been privileged to work with a number of teachers studying other aspects of stunt tests, some as yet unreported.[3] I have analyzed some of these data still farther. I am convinced that the stunt type of approach to this kind of test justified Dr. Brace's faith in it; but that much more work needs to be done on these tests, both as to the study of fundamental components of each stunt used, and the selection of scoring and weighting of these stunts, before the best kind of results may be obtained. The effects of practice must be determined, and perhaps several sets of norms provided. At present these tests are valuable, but only in a large, rough way. I believe that they can be made much more valuable and much more selective than they are at present in even the best stunt tests now available.

The list of stunts used, the selections from those for each age group, and the score equivalents are given below. I am indebted to Dr. D. K. Brace and to the publisher, A. S. Barnes and Company, for permission to quote selected statements from the book, *Measuring Motor Ability*.

[3] Kenneth Hill, "The Formulation of Tests of Motor Educability for Junior High School Boys," Reported at the Central District Convention at Omaha, 1936.

D. W. Harshbarger, "An Evaluation of the Brace Test of Motor Skills Educability," Master's Thesis, State University of Iowa, 1936.

Gertrude Barton, "A Comparative Study of the Brace Type of Test and the Johnson Type of Test as Measurers of Motor Educability in the Junior High School Girl," Master's Thesis, State University of Iowa, 1935.

Hazel Roads, "A Comparative Study of the Brace Type of Test and the Johnson Type of Test as Measurers of Motor Educability in the Senior High School Girl," Master's Thesis, State University of Iowa, 1936.

TEST OF MOTOR EDUCABILITY

(Iowa Revision of the Brace Scale of Motor Ability Tests)

Instructions for administering this test can be found in *Measuring Motor Ability* by David K. Brace, published by A. S. Barnes and Company. These instructions should be read carefully and thoroughly understood before the test is begun. The original Brace test included twenty stunts given in four alternating batteries of five. Our revised battery has ten stunts which may be given in *two* batteries of five. The ten selected are different for each group, and are indicated below. The instructions are as follows: Divide the class into two sections (as directed by Brace). Give the *first* half of the test to Section One, then the *second* half of the test to Section Two; then the *second* half of the test to Section One, and the *first* half of the test to Section Two. This alternation of the halves is to obviate as much as possible the advantages that Section Two would gain from watching Section One go through the entire test.

Some of the stunts given in Dr. Brace's book have been included in these batteries. Wherever this has been done, credit is given Dr. Brace by including the original number of the stunt in his battery in parentheses following the numbering given for the Iowa Revision.

In some stunts a number of counts is indicated. In order to make these counts approximate the same number of seconds—that is, to prevent the children from counting off the required number as fast as they can say the numbers—it is suggested that the teacher instruct them to count thus: one thousand and ONE, one thousand and TWO, one thousand and THREE, one thousand and FOUR, etc.

Test 1. One Foot—Touch Head.—(Brace No. 13) Stand on the left foot. Bend forward and place both hands on the floor. Raise the right leg and stretch it back. Touch the head to the floor, and regain the standing position without losing the balance.

It is a failure:
1. Not to touch the head to the floor.
2. To lose the balance and have to touch the right foot down or step about.

Test 2. Side Leaning Rest.—Sit down on the floor, legs straight out and feet together. Put right hand on the floor behind you. Turn to the right and take a side leaning rest position, resting on the right hand and right foot. Raise the left arm and leg and keep this position for five counts.

It is a failure:
1. Not to take the proper position.
2. Not to hold the position for five counts.

Test 3. Grapevine.—(Brace No. 14) Stand with both feet tight together. Bend down, extend both arms down between the knees, around behind the ankles, and hold the fingers together in front of the ankles without losing the balance. Hold this position for five seconds. (Counted by scorer.)

It is a failure:
1. To fall over.
2. Not to touch and hold the fingers of both hands together.
3. Not to hold the position for five seconds.

Test 4. One Knee Balance.—Face to the right. Kneel down on one knee with the other leg raised from the floor and arms stretched out at the side. Hold your balance for five counts.

It is a failure:
1. To touch the floor with any other part of the body than the one knee.
2. To fall over.

Test 5. Stork Stand.—(Brace No. 18) Stand on the left foot. Hold the bottom of the right foot against the inside of the left knee. Place hands on hips. Shut both

eyes and hold the position for ten seconds without shifting the left foot about on the floor.

It is a failure: 1. To lose the balance.
2. To take the right foot down.
3. To open the eyes or remove the hands.

Test 6. Double Heel Click.—(Brace No. 8) Jump into the air and clap the feet together twice and land with the feet apart (any distance).

It is a failure: 1. Not to clap the feet together twice.
2. To land with the feet touching each other.

Test 7. Cross Leg Squat.—(Brace No. 17) Fold the arms across the chest. Cross the feet and sit down cross-legged. Get up without unfolding the arms or having to move the feet about to regain the balance.

It is a failure: 1. To unfold the arms.
2. To lose the balance.
3. To be unable to get up.

Test 8. Full Left Turn.—(Brace No. 7) Stand with feet together. Jump into the air and make a full turn to the left, landing on the same spot. Do not lose the balance or move the feet after they strike the floor.

It is a failure: 1. Not to get all the way around.
2. To move the feet after they strike the floor.

Test 9. One Knee; Head to Floor.—Kneel on one knee with other leg stretched out behind, not touching the floor; arms out at side parallel to floor; bend forward, touch the head to the floor and raise the head from the floor without losing the balance.

It is a failure: 1. To touch the floor with raised leg or with any other part before completing the stunt.
2. Not to touch the head to the floor.
3. To drop the hands.

Test 10. Hop Backward.—Stand on either foot. Close the eyes and take five hops backward.

It is a failure: 1. To open the eyes.
2. To drop the other foot.

Test 11. Forward Hand Kick.—Jump upward, swinging the legs forward, bend forward and touch the toes with both hands before landing. Keep the knees as straight as possible.

It is a failure: 1. Not to touch both feet while in the air.
2. To bend the knees more than 45 degrees.

Test 12. Full Squat; Arm Circles.—Take full squat position with arms out sidewise, arms so that the hands make a circle about one foot across, and jiggle up and down at the same time for ten counts.

It is a failure: 1. To move the feet about on the floor.
2. To lose the balance and fall.
3. To touch any other part than the feet to the floor.
4. Not to move the hands in a circle.
5. Not to jiggle up and down.

Test 13. Half Turn Jump; Left Foot.—Stand on the left foot and jump one half turn to the left; keep the balance.

It is a failure: 1. To lose the balance.
2. To fail to complete the half turn.
3. To touch the floor with the other foot.

Test 14. Three Dips.—(Brace No. 5) Take a front leaning rest position, i.e., place the hands on the floor, arms straight, extend the feet back along the floor until the body is straight (in an inclined position to the floor). Bend the arms, touching the chest to the floor, and push up again to straight arms. Do this three times in succession. Do not touch the floor with the legs or waist.

It is a failure to: 1. Not push up three times.
2. Not touch the chest to the floor each time.
3. Rest the knees, thighs, or waist on the floor at any time.

Test 15.—Side Kick.—Throw left foot sideways to the left, jumping upward from the right foot; strike the feet together in the air and land with the feet apart. The feet should strike outside the left shoulder line.

It is a failure: 1. Not to swing the feet enough to the side.
2. Not to strike the feet together in the air.
3. Not to land with the feet apart.

Test 16. Kneel, Jump to Feet.—(Brace No. 16) Kneel on both knees. Extend the toes of both feet out flat behind. Swing the arms and jump to the feet without rocking back on the toes or losing the balance.

It is a failure: 1. To have the toes curled under and rock back on them.
2. Not to execute the jump, and stand still on both feet.

Test 17. Russian Dance.—Squat clear down; stretch one leg forward; do a Russian dance step by hopping to this position with first one leg extended, then the other; do this twice (that is, twice with each leg). The heel of the forward foot may touch the floor.

It is a failure: 1. To lose the balance.
2. Not to do the stunt twice with each leg.

Test 18. Full Right Turn.—(Brace No. 15) Stand with both feet together. Swing the arms and jump up in the air, making a full turn to the right. Land on the same spot and do not lose the balance, that is, do not move the feet after they first strike the floor.

It is a failure: 1. Not to make a full turn and land facing the same direction as at the start.
2. To lose the balance and have to step about to keep from falling.

Test 19. The Top.—Sit down; put the arms *between* the legs and *under* and *behind* the knees; grasp the ankles; roll rapidly around to the right with the weight first over right knee, then right shoulder, then on back, then left shoulder, then left knee; then sit up facing the *opposite* direction from which you started. Repeat from this position and finish facing in the *same* direction from which you started.

It is a failure: 1. To let go of the ankles.
2. Not to complete the circle.

Test 20. Single Squat Balance.—Squat clear down on either foot. Stretch the other leg forward off the floor, hands on hips. Hold this position for five counts.

It is a failure: 1. To remove the hands from the hips.
2. To touch the floor with the extended foot.
3. To lose the balance.

Test 21. Jump Foot.—(Brace No. 10) Hold the toes of either foot in the opposite hand. Jump up and jump the free foot over the foot that is held without letting go.

It is a failure: 1. To let go of the foot that is held.
2. Not to jump through the loop made by holding the foot.

STUNTS USED FOR EACH GROUPING IN SCHOOL

Elementary Grades 4–6		Junior High School Grades 7–9		Senior High School Grades 10–12	
1st half	2nd half	1st half	2nd half	1st half	2nd half
Boys					
10	2	1	2	1	3
4	3	14	3	11	14
13	7	13	12	16	15
11	16	19	16	5	17
8	17	6	17	20	21
Girls					
10	1	2	1	3	2
18	3	12	13	11	18
8	16	15	11	7	16
19	15	19	16	17	9
11	6	17	20	19	20

SCORING TABLE

The "T" scores for the stunts are based on two trials for each stunt. If the pupil succeeds the first trial, score two points; if he fails the first trial but succeeds the second trial, score one point. If he fails both trials, score zero. The highest possible score is twenty. These "T" scores vary from group to group because of the different degree of difficulty of the various combinations of ten stunts as well as the varying degree of maturation of the groups. The "T" scores are as follows:

Points	"T" Scores					
	Boys			Girls		
	Elem.	Jr. High	Sr. High	Elem.	Jr. High	Sr. High
20	69	66	71	67	64	71
19	66	63	65	65	61	66
18	63	60	60	62	58	63
17	60	57	56	60	56	60
16	57	54	53	58	53	57
15	54	51	50	56	50	55
14	51	48	47	54	47	53
13	48	45	44	52	45	51
12	45	42	41	50	43	49
11	43	39	38	48	41	47
10	41	36	35	45	39	45
9	39	34	33	42	37	43
8	37	32	31	39	35	41
7	35	30	29	36	32	39
6	33	28	..	33	30	37
5	31	26	..	30	26	34
4	29	24	..	28	..	32
3	27	22	..	26	..	30
2	25	20	..	24	..	28
1	23	19	..	..	..	..

The Interests and Participation of Boys and Girls in Out-of-School Recreation Activities

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INTRODUCTION

DURING the past five years there has been an increased emphasis on the importance of preparation for leisure. There has been a growing recognition on the part of public and private agencies that they have an obligation to the child in his preparation for this new leisure.

As these various agencies have become alert to their responsibility and opportunity they have in turn challenged their employed personnel to restudy and evaluate their own program in the light of the new social situation. This has been particularly true of the profession of physical education. The school physical director and the directors of private agencies such as the Y.W.C.A., Y.M.C.A., and of settlements, parks, and playgrounds have constantly faced the problem of changing the emphasis of their program to meet more adequately the needs of their constituency.

It is not assumed by the writer that interest should be the sole criterion upon which any program of recreation should be planned. However, programs of activities which do not consider the interests of the participants, and are carried on under compulsion, are often dropped as soon as compulsory measures are released.

There has been considerable study of various age levels to find the interest of children in play. In the main, they have been studies of the younger child, a single sex, or a single group in one town. The study herein discussed has been directed toward a better understanding of the interests and participation of boys and girls of the senior high school, and freshmen in college, of five different schools, in the students' out-of-school recreation activities.

ORGANIZATION AND PROCEDURE

A. STATEMENT OF PROBLEMS

The following list of problems suggests the limits of this study.

In what specific recreation activities are boys and girls interested?

Abstract from a Master's Thesis, University of Chicago, Department of Education, 1935.

In what specific recreation activities do boys and girls participate?

What is the relationship, if any, between the activities which boys and girls say they like, and the activities in which they say they participate?

What are the differences, if any, in interest in recreation between girls and boys?

What are the differences, if any, in participation in recreation activities between girls and boys?

What is the relationship of social and economic status of boys and girls to participation in recreation activities?

What is the relationship of the community to participation in recreation activities?

What are the differences, if any, in interest and participation of recreation activities between town and country boys and girls?

B. Terms to be Used

Interest.—As the term is used in this study, interest in recreation activities is an activity interest expressed by the words like, dislike, neutral, and prefer. The word "prefer" is used as a means of indicating degrees of interest and may be said to be more discriminating than "like."

Participation.—As the term is used in this study, it means the degree to which a boy or girl has participated in any single activity. To assist the student the terms ***much, little,*** and ***none*** were used as descriptive terms. *None* is very definite. ***Much*** or ***little*** may not mean the same to everyone but they do indicate that some activities are participated in more than others.

C. Materials of the Study

Check list questionnaire.—This was the method used in this study. This questionnaire was completed with the help of physical directors in the areas being studied. The final check-list of sixty-six activities can be divided into seven different categories: team games, individual and dual games, nature activities, crafts, artistic expression activities, passive activities, and social activities.

Sources of Data.—Girls and boys of the junior and senior grades in high school and one group of junior college students were chosen to represent the age range of this study.

Paw Paw High School in Paw Paw, Illinois, a small country town of six hundred inhabitants, was chosen to give a picture of the country boy and girl.

Tuley High School on the west side of Chicago was chosen because its community lacked many of the common recreational advantages of the other communities. Moreover it was believed that the parents represented a lower class in the socio-economic scale.

University High School was chosen because it was thought to represent a group of students from homes in the upper social and economic levels.

New Trier High School, Winnetka, Illinois, was chosen because it

TABLE I

ACTIVITY GROUPINGS

*Team**	*Individual and Dual Athletic Activities*
10 per cent	29 per cent
Softball	Track and field
Hard baseball	Ice hockey
Basketball	Golf
Volleyball	Tennis
Football	Archery
Touch football	Rifling
Soccer	Handball
Crafts	Bicycling
14 per cent	Horseshoes
Handicraft	Boxing
Cooking	Wrestling
Leathercraft	Skiing
Aeroplane making	Swimming
Radio making	Diving
Carpentry	Ice skating
Photography	Bowling
Sewing	Pool and billiards
Knitting	Roller skating
Sedentary Activities	Table tennis
14 per cent	*Outdoor Recreational Activities*
Watching sports	12 per cent
Movies	Hiking
Radio	Sailing
Auto riding	Camping
Conversation	Fishing
Reading books	Boating
Reading newspapers	Canoeing
Smoking	Nature lore
Writing letters	Kite flying
Artistic Expression	*Social Activities*
7 per cent	14 per cent
Painting	Group games
Singing	Card games
Dramatics	Checkers and chess
Play musical instruments	Social dancing
Orchestra	Folk dancing
	Social clubs
	Having "dates"
	Going to parties
	Visit with company

* Indicates that team activities constitute 10 per cent of all the activities in the check list.

represented the suburban home and neighborhood as well as the upper level of social and economic life.

George Williams College in Chicago was chosen to give a picture of the college freshman living at home and just a year out of high school.

Personnel of the Study.—The attempt was made in this study to secure an equal number of boys and girls from each school and to select them from a grade that would give a fairly similar age grouping. A total of three hundred and sixty-three questionnaires was available, with a slight difference in the total for each sex. The questionnaires were completed between March first and March fifteenth.

Other information such as age, intelligence-quotient, and social-economic status of parent gave added support to the belief that the three hundred and sixty-three students cooperating are a fairly good cross-section of students in high school and college.

RESULTS OF THE STUDY

A. What is the interest and participation of boys and girls in the various activity groupings as referred to in Table I?

Team Activities.—Basketball, softball, and hard baseball rank first, second, and third in interest and participation among boys. These are followed closely by football and touchball. Basketball, softball, and volleyball are the leading activities among the girls.

Individual and Dual Activities.—The boys' interests run to tennis, table tennis, swimming, bicycling, and ice skating. The highest amount of participation is in swimming, table tennis, tennis, and ice skating. In both interest and participation, the girls favor five activities: swimming, tennis, bicycling, table tennis, and roller skating.

Outdoor Recreational Activities.—Though interest, among the boys and girls, is great in all of these, hiking alone is realized by a considerable number.

The Crafts.—This is an area in which the activities have not captivated the interests of the boys. Of the small interest and meager participation, photography, handicraft, carpentry, and cooking rate well above the other activities.

Among the girls one finds both an interest and an opportunity for expression in cooking, sewing, and knitting. These rank far ahead of other crafts. There is an interest, but little participation, in handicrafts and photography.

The Arts.—Though finding response with only a limited number of boys, the interest and participation was highest in singing and in the playing of musical instruments.

The interest was considerably greater from the girls, but the activities chosen to respond to were, again, singing and playing musical instruments.

Sedentary Activities.—The order of interest in this grouping among

boys was radio, auto riding, movies, watching sports, reading newspapers, conversation, reading books, smoking, and writing letters. In actual participation the first three are radio, watching sports, and auto riding. Only 17 per cent of the boys indicated that they smoked considerably.

A similar picture is true of the girls, with one exception. Watching sports is high in interest among girls, but only 52 per cent of the girls watch sports a great deal. Only 10 per cent of the girls smoke much, and only 15 per cent were interested in smoking at all.

Social Activities.—Although a good percentage of the boys were interested in social dancing, parties, dates, and playing cards, social dancing and dates are the only activities in which about 50 per cent participate. Folk dancing is participated in by only 6 per cent of the boys.

All of the activities of this group with the exception of folk dancing are of interest to the larger number of girls, but social dancing, having dates, visiting, and playing cards receive the most attention in participation.

B. What is the relationship of interests and participation by communities?

Summary of Relationships of Interests and Participation by Communities.—There appear in the results certain tendencies, or points of difference, between the boys and girls of the various schools.

Interest.—There were three activities—movies, auto riding, and radio—liked by over 75 per cent of the boys of all the schools. Pool and billiards, hiking, and horseshoes were interests of the Paw Paw boys. Table tennis and rifling were both interests of a large percentage of the University High boys. Basketball and bicycling were unique in amount of interest shown by the Tuley High School boys. Social dancing, boating, sailing, and camping were activities enjoyed by the New Trier High School boys. Ice skating and conversation were exceptionally high as rated by the George Williams College boys.

The girls of the various schools also differed in the extent of interests in the different activities. The Paw Paw girls listed cooking, singing, and roller skating as the interests of a large number. The University High School girls placed conversation, bicycling, reading, and painting high among their interests. The girls of Tuley High School show a real interest in social dancing, social clubs, and sewing. The girls of New Trier High School are very similar to the girls from University High School. This is to be expected, for they came from practically the same kind of school and from the same home social-economic status. The George Williams College girl shows a greater interest in the social and passive activities.

The extent of interests among the students of the various schools,

may be examples of community offerings of these respective schools. See Tables II and III.

Participation.—The participation of the students of the various schools has, in all probability, been influenced to a much greater extent by the economic position of the family and the community and school offerings in the respective towns. The Paw Paw students were interested in a great variety of activities, but participated in comparatively few. This town has a very limited amount of recreation equipment. The students of University High School were able to participate in the activities denied Paw Paw students—such as photography, handicraft, sailing, canoeing, and tennis. The Tuley students indicate a real use of community facilities in their participation in activities sponsored by the community, namely, social clubs, basketball, social dances, sewing, and bicycling. However, they did not participate to a large degree in expensive activities such as golf, archery, fishing, and sailing. The students of New Trier reflect their community and their economic status in their participation in tennis, golf, knitting, sailing, and ice skating. The students of George Williams College show the effect of a program of recreation as conducted by the College in their participation in folk dancing, table tennis, and group games.

C. What are the preferences and the activities participated in most by these boys and girls?

Tables II and III present the activities preferred and participated in most by boys and girls.

TABLE II

ACTIVITIES PREFERRED AND PARTICIPATED IN MOST BY 194 BOYS

Rank	Preference	Rank	Most Participation
1.	Basketball	1.	Basketball
2.	Swimming	2.	Swimming
3.	Baseball	3.	Baseball
4.	Tennis	4.	Tennis
5.	Football	5.	Movies
6.	Softball	6.	Softball
7.	Golf	7.	Reading books
8.	Social dancing	8.	Radio
9.	Movies	9.	Auto riding
10.	Reading books	10.	Football
11.	Having dates	11.	Social dancing
12.	Radio	12.	Golf
13.	Ice skating	13.	Table tennis
14.	Camping	14.	Track and field
15.	Bicycling	15.	Hiking
16.	Hiking	16.	Reading newspapers
17.	Boxing	17.	Conversation
18.	Watching sports	18.	Ice skating
19.	Sailing	19.	Singing

TABLE III

ACTIVITIES PREFERRED AND PARTICIPATED IN MOST BY 169 GIRLS

Rank	Preference	Rank	Most Participation
1.	Swimming	1.	Social dancing
2.	Social dancing	2.	Reading books
3.	Tennis	3.	Swimming
4.	Movies	4.	Movies
5.	Reading	5.	Tennis
6.	Softball	6.	Radio
7.	Golf	7.	Conversation
8.	Basketball	8.	Softball
9.	Sewing	9.	Auto riding
10.	Bicycling	10.	Having dates
11.	Having dates	11.	Cooking
12.	Auto riding	12.	Sewing
13.	Roller skating	13.	Hiking
14.	Hiking	14.	Singing
15.	Conversation	15.	Golf
16.	Radio	16.	Roller skating
17.	Ice skating	17.	Watching sports
18.	Singing	18.	Playing musical instruments
19.	Cooking	19.	Knitting

Summary.—The boys prefer the team and individual activities for their recreation, and participate in a few of them in excess of other activities. Some less active activities, like the radio and movies, do appear to a greater extent in participation than the boys would prefer. Though preferring other activities, the passive, easy-to-do activities are participated in to a large extent.

The girls prefer a combination of individual, social, and passive activities among their first choices, and carry this preference into their actual participation, with some minor changes as to order of interest and participation.

What are the interests and participation of all students?

Table IV gives a clear picture of the activities liked by over 50 per cent of the boys and girls. Passive activities like "listening to the radio," "auto riding," and "going to the movies" rank first among interests of boys. However, the active sports of "baseball," "softball," and "swimming," though second as a group, lead the inactive "watching sports." It is interesting to note that social dancing is listed as the eighth interest, with 67 per cent of the boys liking this activity. Following this come the individual and dual activities like "tennis," "boating," and ice skating.

The largest number of girls and boys list radio as one of their interests. Where only 56 per cent of the boys indicate they like to have

dates, 91 per cent of the girls indicate an interest in this experience. With the exception of swimming, which is an interest of 89 per cent, the nine activities enjoyed by 80 to 92 per cent of the girls are all of a social or of a passive nature. The individual and dual activities, though less popular than the preceding activities, are liked by a larger number of girls than the team games.

TABLE IV

ACTIVITIES LIKED BY OVER 50 PER CENT OF THE BOYS AND GIRLS
(194 BOYS, 169 GIRLS)

Activities	Per cent Boys	Activities	Per cent Girls
Listening to radio	86	Listening to radio	92
Auto riding	83	Having dates	91
Going to movies	82	Going to movies	91
Softball	75	Swimming	89
Swimming	73	Social dancing	89
Basketball	71	Auto riding	87
Watching sports	70	Watching sports	84
Social dancing	67	Reading books	83
Table tennis	66	Conversation	81
Tennis	65	Tennis	81
Boating	65	Roller skating	80
Canoeing	63	Going to parties	72
Fishing	63	Table tennis	71
Reading newspapers	60	Reading newspapers	69
Camping	60	Boating	67
Conversation	58	Bicycling	65
Ice skating	58	Canoeing	65
Football	58	Basketball	64
Going to parties	57	Card games	63
Having dates	56	Hiking	63
Hard baseball	55	Diving	62
Reading books	54	Camping	61
Bicycling	53	Ice skating	52
Pool, Billiards	53	Singing	52
Touch football	51	Sailing	52
Rifling	50	Social clubs	51
		Volleyball	50
		Visiting with company	50

Both girls and boys are interested in passive amusements but more of the boys than girls like active team and individual games. A greater number of the girls like the less active social recreational activities.

Table V shows the largest number of activities participated in by between 50 and 69 per cent of the boys with less activities at the extremes. The opposite is true of the girls as is shown by Table VI. Here the greater number are at the extremes.

The girls' spread is away from the median, while the boys' per-

centage clusters around the median. This situation warrants the conclusion that a larger number of the boys participate in a variety of activities. A large number of the girls participate in a few activities, but many activities are participated in by a few girls.

D. What is the relationship of interest and participation between the sexes?

TABLE V

TOTAL PARTICIPATION IN PERCENTAGE GROUPS
(194 BOYS)

90–99	80–89	70–79
Movies	Softball	Cards
Watching sports	Reading newspapers	Having "dates"
Auto riding	Basketball	Visiting with company
Radio	Table tennis	Social dancing
Swimming	Tennis	Fishing
Conversation	Going to parties	Hiking
Reading books		Writing letters
		Bicycling
60–69	**50–59**	**40–49**
Ice skating	Social clubs	Carpentry
Hardball	Roller skating	Rifling
Pool, Billiards	Canoeing	Handicraft
Checkers, Chess	Singing	Smoking
Boating	Horseshoes	Nature lore
Football	Track, field	Dramatics
Camping	Volleyball	Sailing
Group games	Golf	
Diving	Handball	
Touchball	Wrestling, boxing	
	Photography, cooking	
30–39	**20–29**	**10–19**
Bowling	Skiing	Radio building
Soccer	Kite flying	Folk dancing
Musical instrument	Archery	Sewing
Painting		Orchestra
Ice hockey		Leathercraft
Aeroplane building		

In Tables II and III the preferences of girls and boys are indicated. Of the nineteen activities preferred by boys, all but six are included in the girls' list of nineteen activities. Five of these are typical boy activities—hard baseball, football, boxing, sailing, and camping. The six activities listed among the girls' preferences, but not included on the men's list are sewing, roller skating, auto riding, conversation, singing, and cooking. This leaves thirteen similar activities preferred by both boys and girls. The largest number of boys prefer the active team and

TABLE VI

TOTAL PARTICIPATION IN PERCENTAGE GROUPS
(169 GIRLS)

90–99	80–89	70–79
Movies	Watching sports	Hiking
Reading books	Having dates	Reading newspapers
Conversation	Table tennis	Sewing
Radio	Tennis	Bicycling
Auto riding	Cards	Social clubs
Social dancing	Roller skating	
Swimming	Cooking	
Going to parties		
Writing letters		
Visiting company		
60–69	**50–59**	**40–49**
Basketball	Boating	Golf
Volleyball	Diving	Musical instruments
Ice skating	Canoeing	Photography
Singing	Camping	Handicraft
Group games	Checkers, chess	Sailing
Softball		Fishing
		Dramatics
30–39	**20–29**	**10–19**
Knitting	Smoking	Touchball
Painting	Archery	Skiing
Handball	Bowling	Orchestra
Soccer	Folk dancing	Track, field
Nature lore	Horseshoes	Leathercraft
		Rifling
		Hardball
		Pool, billiards
0–9		
Kite flying		
Airplane building		
Carpentry, boxing		
Wrestling, ice hockey		
Radio making, football		

the individual games, while the girls prefer the individual and social activities. An illustration of this difference is shown in the first five activities in the rank order of preference between girls and boys:

Boys	*Girls*
Basketball	Swimming
Swimming	Social dancing
Baseball	Tennis
Tennis	Movies
Football	Reading

However, it is of interest to point out some particularly noticeable relationships between boys and girls in their interests and participation. Basketball, tennis, and swimming are the three physical activities in which both sexes are interested and participate. There is a greater interest on the part of girls than boys in the areas of arts, crafts, and nature activities. Among the nature activities both boys and girls participated alike in hiking. In the arts, singing and playing musical instruments were the common activities participated in by boys and girls. In the area of crafts, girls found their expression in cooking, sewing, and knitting; while the boys choose to participate only in photography. It is in the area of social activities where girls and boys both agree and disagree. There is agreement in favor of social dancing and disfavor of folk dancing by a large number. Both girls and boys are interested in parties and dates, but the girls participate in them to a larger extent than do the boys.

Although there is not presented conclusive proof, there seems to be an indication that one sex parallels the other in interests in the various school communities. Both boys and girls from Paw Paw are interested in hiking and tennis; from University High in the social dance and conversation; from Tuley in auto riding and social clubs; and from New Trier in sailing, boating, and canoeing.

Tables V and VI, in showing the total participation of both sexes, lead one to the conclusion that a larger number of boys participate in a great variety of activities; a large number of girls participate in a few activities, but a few girls participate in a large number of activities. This suggests the wider choice of activities by many boys and the limited and intensive participation of girls in a few activities.

GENERAL SUMMARY OF RESULTS

With some few exceptions, the following activities are liked by the boys of all schools: movies, auto riding, swimming, radio, tennis, watching sports, softball, and basketball.

With several exceptions, the following activities are liked by girls of all schools: radio, swimming, social dancing, auto riding, tennis, movies, conversation, having dates, roller skating, and watching sports.

The activities in which most of the boys participated are movies, auto riding, watching sports, radio, swimming, conversation, and reading books.

The activities in which most of the girls participated are movies, reading books, conversation, radio, auto riding, social dance, swimming, going to parties, writing letters, and visiting with company.

The interests of the boys are spread over a large variety of activities, while many girls are interested in comparatively few activities.

With a few exceptions, differences in facilities and social economic status of the students did not affect the interests of boys and girls.

In the various school communities there was a definite parallel between the interests of the girls and of the boys of each school.

The boys prefer the team and individual type of physical activities.

The larger number of girls prefer a mixture of individual physical activity, social, and passive activities.

The amount of participation experienced by both girls and boys is not commensurate with the amount of interest indicated. This is more true of the girls.

The girls indicate a definite interest in the physical activities, but participate in the less strenuous ones.

With a few exceptions, it does not appear that participation is the main means of motivating interest in recreational activities.

Expressed desires of individuals can only be realized as opportunities are made available through community provision for them.

School programs and community facilities have been the cause of varied differences in participation between the students of the different schools.

It appears that the economic status of some students was a strong factor in determining the activities participated in by these students. Low cost and availability of the activity determined participation for many.

The interests of college students was not noticeably different from high school students. The college students did tend to participate in those activities which were less time-consuming.

Girls and boys do not prefer but they do enjoy participating with the opposite sex in tennis, ice skating, social dancing, watching sports, hiking, bicycling, and boating.

High school students are unwilling to admit they do not participate in recreational activities because of lack of skill, lack of leadership, or failure to find an opponent or a partner.

The boys and girls of this study participate in the main in those activities which are usually promoted by recreational agencies.

The recreation leader and the school administrator should take cognizance of the preferred interests and amount of participation of boys and girls in his community. The program should be based on facts related to the needs and interests of individuals, and the activities selected should be those that meet the needs and interests of boys and girls.

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Studies in Strength Testing for High School Girls

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In A previous publication the author presented a study of the relationship of strength tests to athletic ability in high school girls.[1] The criterion used to determine athletic ability was the score of five track and fields events. These were scored on appropriate scoring tables and the scores totaled. Comparative multiple correlations with this criterion were presented of:

1. A long weighted strength index consisting of grips, pull-ups, dips, weight, back lift, leg lift, push, pull, and thigh flexors. The multiple correlation with these was .5507.

2. A shorter weighted battery consisting of thigh flexors, push, leg lift, grips, and weight. The multiple correlation here was almost as high, being .5303.

3. A still shorter weighted battery using only grip, right and left, and the push and the pull gave almost as high a correlation, .4939.

4. A weighted short battery testing the back muscles and the leg muscles and combined with weight gave a correlation of .5270.

5. The unweighted P.F.I. correlated .440 with total points of track and field.

6. A weighted P.F.I. was devised by computing the multiple regression equation for the variables using the same variables as those used in the short form above. The multiple correlation was .489.

Multiple regressions were computed for such of these as seemed useful.

The literature on strength testing was reviewed in the above study so will not be repeated here.

In the present study, the same girls were used. They consisted of 300 girls of grades ten and eleven in North High School, Des Moines, Iowa. All were students of the investigator. Only students taking the regular physical education work were used. Those crippled in any way were eliminated. The same strength data were utilized as for the previous study. In addition, four other types of criteria were secured, and the records for the best Sargent Jump recorded. These studies will be reported below in turn.

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[1] Theresa Anderson, "Weighted Strength Tests for the Prediction of Athletic Ability in High School Girls," *Research Quarterly*, VII: 1 (March, 1936), p. 136.

STUDIES OF STRENGTH TESTS AND THE SARGENT JUMP AS DEVICES FOR CLASSIFYING

Five items, weighted according to the weightings used in the study of athletic ability were used:

1. Unweighted Strength Index
2. Weighted Strength Index
3. Unweighted P.F.I.
4. Weighted P.F.I.
5. Sargent Jump

These were correlated against a subjective rating made by the investigator. In this rating, girls were placed in seven groups: *very* superior, superior, better than average, average, poorer than average, poor, and *very* poor. The groups were carefully studied from many angles, but the final placement was largely based upon homogeneity for general motor performance. The zero order correlations computed were as follows:

Correlations of:	*with classification*	*with Sargent Jump*
Unweighted strength index	.437	.451
Weighted index	.417	.347
Unweighted P.F.I.	.425	.400
Weighted P.F.I.	.345	.354
Sargent Jump	.609	

From the above correlations it would seem that the strength index is superior to the P.F.I. for the purpose of classification, but that the Sargent Jump is so far superior to the Strength Index for this purpose, that if only one is to be used, the Sargent Jump is far the better choice. The best weighted combination of the Sargent Jump and the unweighted Strength Index correlates .646 with the classification. Since the strength tests give other valuable information concerning the girls, this combination is to be preferred if the administration is feasible. The Sargent Jump correlated .540 with track and field athletics (total points).

THE CORRELATION OF STRENGTH TESTS WITH HEALTH RATINGS

Health ratings were made both by the instructor and by the girl herself. Only girls whose ratings agreed with those of the instructor were used in the study. A rating of "one" was recorded if the girl felt top notch practically all of the time. She seldom felt tired. A rating of "two" was given if she felt she was better than average but not quite so good as the "ones."A rating of "three" was given if the girl felt she was just about average. She didn't feel bad, but she didn't feel very peppy either. A rating of "four" was given if the girl felt draggy, and tired easily. A rating of "five" was to indicate that the girl felt she should be under a doctor's care. We had no "fives" as these were excused from active participation in class work.

The zero order correlations of the individual strength tests with this rating were as follows:

Grips ..... .2077	Thigh Flexors .. .2069	Weight ..... .1484
Pull Ups ..... .1874	Push ..... .1436	Leg lift ..... .1747
Dips ..... .2219	Pull ..... .1611	Back lift ..... .2668

The multiple correlation of health with this whole battery was but .318. Smaller batteries were also tried. One consisting of pull-ups, thigh flexors, back lift, and grips correlated .318 with the ratings. None of these are high enough to be of much value.

Validity.—The validity of the rating will probably be questioned. It is of course not at all comparable to a complete careful, medical examination, but feelings in health can be determined by no one else than the girl herself. She alone knows how she feels. The investigator realizes that this is an incomplete criterion, but it is probably as adequate as a school medical examination of the usual length and incompleteness as a test of general functioning health.

Correlations of:	*with health*
1. Strength Index unweighted	.265
2. Strength Index weighted	.222
3. P.F.I. unweighted	.158
4. P.F.I. weighted	.265

The zero order correlations of health and the strength variables were made by an extension of the Biserial method to take in multiple categories.

THE RELATIONSHIP OF STRENGTH TESTS TO TEST OF ENDURANCE

Frederick Rand Rogers in his text *Test and Measurement Programs in the Redirection of Physical Education* (1927) page 40, has stated that the P.F.I. and the Strength Index were highly correlated with endurance. No proof for this statement was offered. It was decided to study this aspect of strength testing.

This phase of the present study and the next phase are attempts to investigate this proposal. In the first phase of the study an attempt was made to measure what might be called cardio-respiratory endurance, such as that which permits of prolonged fast running.

An "endurance ratio" was computed by dividing the time for the 150-yard dash by the time for the 40-yard dash, the smaller ratios being the best.

A further study attempted to measure the relationship of strength tests to the kind of endurance exhibited in continued, fairly strenuous effort, exercise that is not fast enough to induce cardiac distress.

Three criterion exercises were used:

1. Squats 2. Forward Bends 3. Thigh flexing

The squats were done to the rhythm of a metronome set at 72.

The forward bends were done as follows: In order to create fatigue with a lesser number of bends, a 32 pound weight was placed at the base of the neck and held in place with the hands. The bend was a 90° angle.

The thigh flexors were tested by having the girl hang from the stall bars and raise the legs to a right angle with the trunk. Legs were kept straight. The number of times the exercise was done was recorded for each girl.

The resulting zero order correlations with each strength test were as follows:

Thigh flexors	Total Points	Grips	Pull Ups	Dips	Thigh Flexors	Push	Pull	Weight	Leg Lift	Back Lift	Age
Endurance	.206	.309	.294	.195	.118	.096	.153	.015	.130	.190	.118
Forward Bends	.022	.150	.376	.306	.198	.204	.040	.229	.160	.110	.176
Squats	.016	.019	.065	.248	.198	.142	.209	.041	.209	.201	.113
Endurance Ratios	.103	.167	.033	.193	.020	.221	.133	.191	.046	.202	.067

Although none of the zero order correlations seemed particularly exciting, combinations were tried with the following results. In the following tables, the variables are numbered as follows:

0–criterion variable
1–grip
2–pull up
3–dips
4–thigh flexors
5–push
6–pull
7–leg lift
8–back lift
9–weight
a–age

Endurance Ratio:

Ro .135689 = .2793
Ro .5689 = .2783

Squats:

Ro .345678a = .3421
Ro .3568 = .3376
Ro .356 = .2978

Forward Bends:

Ro .123456789 = .4822
Ro .12345 = .4693
Ro .1234 = .4675
Ro .123 = .4539

Thigh Flexors:

Ro .12345678 = .4264
Ro .1234 = .4182
Ro .123 = .3783

Simplified multiple regressions were then computed for the most practical combinations. These are as follows:

Endurance ratio—none computed since the multiple correlation was so small.

Squats = 7 Dips + 4 Pull + Leg lift.
(R. = .298)

Forward Bends = 7 Pull ups + 4 Thigh flexors — Back lift.
(R. = .454)

Thigh flexors = 2½ grips + 4½ Pull ups + Thigh flexor strength.
(R. = .378)

The correlations between the P.F.I. (unweighted) and each of the endurance criteria were as follows:

Endurance Criteria	*Unweighted P.F.I.*
Squats	.202
Forward Bends	.234
Endurance Ratio	-.015
Thigh Flexors	.243

None of these is of sufficient size to validate thoroughly Dr. Roger's contention concerning the relationship of strength and endurance, though it is obvious that there is a positive, though low relationship; and a more rigorously controlled study, correcting for attenuation, would probably show more positive evidence to uphold his statements.

The point is, however, that these girls probably represent a better than average sample for this age group. If the strength tests are not particularly meaningful here in this connection they probably will not be generally.

The reliabilities of the individual tests and of the strength index were as follows:

Dips	.813	Back lift	.624	Right grip	.537
Chins	.864	Pull	.603	Left grip	.445
Leg lift	.690	Push	.687	Strength Index	.745

Those are not as high as could be wished and further study as to the cause of this relative unreliability is under way.

SUMMARY

Three studies of strength tests are presented.

1. Strength tests as classifiers for general physical education activities. The best correlation found was .451. Compared with the Sargent Jump (.609) it would not seem worth the trouble to use the strength tests alone for classifying senior high school girls. The Sargent Jump and Strength Index combined give a better correlation, .646.

2. Strength tests were correlated with subjective health ratings. The correlations were low (.318, being the multiple correlation with the battery). Further evidence of the validity of strength tests as predictors of health would seem to be desirable.

3. Strength tests were correlated with tests of endurance. The correlations were uniformly low.

Strength tests for girls seem to give lower correlations with similar criteria than is true with boys. This phenomenon is being studied and will be reported later. Results to date with this group as reported in this and the preceding paper and other papers would seem to indicate that other tests are definitely superior to strength tests as aids to the teacher of girls' physical education.[2]

[2] Marian Niehaus, "A Study of Tests for Dividing High School Girls into Homogeneous Groups for Physical Education," (M.A. Thesis, University of Iowa, 1935).

Comprehensive Tennis Knowledge Test

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AN INCREASINGLY important phase of our modern physical education program is the measurement of a student's knowledge of an activity. There is wide agreement that knowledge of an activity does increase the student's understanding and appreciation of that activity. Therefore, if we are to grade or measure such knowledge, it is imperative the test be constructed according to accepted principles.

The purpose of such a measurement as presented here is fourfold:

1. To diagnose men or women students' knowledge in tennis.
2. To ascertain the degree of improvement or what has actually been learned by the end of the term.
3. To assist in classifying the students into three instructional groups at the start of the term—the beginner, the intermediate, and the advanced.
4. To serve as an objective grading device.

Five years ago the writer worked out a battery of 200 questions on the various component parts of tennis. The questions dealt with are the five most important phases of tennis as stressed by authorities—the history of tennis, equipment necessary, rules of the game, playing situations, and the actual fundamentals.

Four hundred and five students all told have been tested. This was the maximum number that could be collected in the five year period, since up to the summer of 1936 Oregon State College has had only four tennis courts available for instruction.

To validate the criterion, the knowledge test was compared with the following:

1. Scores made by beginning men and women students who have had no instruction—scores were taken at the start and at the end of the term.
2. Scores made by second term men tennis students who have had one term of previous instruction. Scores were taken at the start and at the end of the term.
3. Varsity players' scores.
4. Correlation with the Minnesota Tennis Knowledge Test.

TESTING PROCEDURE

The knowledge test of 200 questions was first given to 104 men and women students at Oregon State College who were taking tennis for gymnasium credit. The means and standard deviations were compared. The probable divergence of difference was found by finding the reliabil-

ity of the averages for men and women and from these the reliability of the difference between the averages. The actual difference from the mean was 13.49 in favor of the women. A difference $\frac{D}{\sigma d}$ of 3 or greater is usually considered indicative of complete reliability.[1] The difference of 2.88 was not wholly significant. See Table I.

The test was then given to a group of second term students. A total of 51 cases of men second termers were given the test before and after instruction. Limitation of facilities prevented the securing of additional cases. The third group were the 10 varsity players. See Tables II and III.

TABLE I

COMPREHENSIVE KNOWLEDGE TEST FOR MEN AND WOMEN (200 QUESTIONS)

	Mean	S. D.	N	σm	σd	$\frac{D}{\sigma d}$
Men	55.72*	23.34	45	3.48	4.68	2.88
Women	69.21*	24.15	59	3.14		

*The means on the 200 battery test are almost double when compared with the 100 battery test. Indicates possible score out of 200.

The original test had 200 questions. Each item was compared with the three groups of abilities, and tabulated as the number marked wrong, answered right, or omitted. Questions that were poorly worded, ambiguous, too easy, or too difficult were eliminated. Beginners were not expected to get more than about 10 per cent of the items correct, while the second termers and the varsity players were expected to get from 50 to 90 per cent right. From the tabulations the 100 questions were selected and placed in their order of difficulty.

SCORING AND TYPES OF QUESTIONS USED

Various new type objective examination questions were used:[2] Thirty True and False, 15 Multiple Choice, 5 Diagrammatic, 10 Completion, 25 Yes and No, and 15 Matching made up the 100 question battery. Scoring used was "Right" minus "Wrong" for the True and False, Yes and No, and Matching items. Multiple Choice scored as $\frac{R-W}{N-1}$ or $\frac{R-W}{4}$ and the Diagrammatic as the "Number Correct."

[1] Henry E. Garrett, *Statistics in Psychology and Education*, (New York: Longmans, Green and Co., 1926), pp. 128–136.

[2] G. H. Ruch, *The Objective or New Type Examination*, (New York: Scott, Foresman and Co., 1929).

Albert A. Lang, *Modern Methods in Written Examinations*, (Boston: Houghton, Mifflin Co., 1930).

Frederick J. Bursch and H. Meltzer, *The New Examination, Its Construction and Use*, (Los Angeles: Southern California School Depository, Ltd., 1931).

INSTRUCTION IMPROVES KNOWLEDGE

By comparing the scores made by students at the start of the term and after the eleven-week period of instruction there was an appreciable improvement of mean scores. See Tables II and III.

TABLE II

COMPARISON OF KNOWLEDGE TEST SCORES FOR 1ST TERM MEN STUDENTS BEFORE AND AFTER INSTRUCTION (200 QUESTIONS)

	Range	Mean	S. D.	N
Start of Term	8— 79*	39.76	18.96	53
End of Term	75—174*	125.70	19.85	53

*Scores out of a possible 200 points.

TABLE III

COMPARISON OF KNOWLEDGE TEST SCORES FOR 2ND TERM MEN STUDENTS BEFORE AND AFTER INSTRUCTION (200 QUESTIONS)

	Range	Mean	S. D.	N
Start of Term	70—135*	91.56	12.68	51
End of 11 Weeks	108—174*	145.80	13.68	51

*Scores out of a possible 200 points.

TABLE IV

KNOWLEDGE TEST SCORES OF VARSITY PLAYERS

	Range	Mean	S. D.	N
Varsity	140—176*	166.42	16.80	10

*Scores out of a possible 200 points.

RELIABILITY

To test the reliability of the 100-question Comprehensive Knowledge Tennis Test two correlations were run. By using the Spearman Brown Prophecy Formula[3] on 105 students, a correlation was found between the odd and even items of the test. For half the examination or fifty questions the coefficient of correlation was $r = .900$, while for the 100 questions there was slight improvement to $r = .947$. See Table VI. As a check for reliability the Minnesota Tennis Knowledge Test[4] was given to 54 men and compared with scores of like number as against the Comprehensive Tennis Knowledge Test. The Minnesota test is not altogether adaptable to men since it was constructed primarily for women. However, the Pearson's Product Moment Coefficient of Correlation of $r = .808 \mp .084$ was high enough to show a good relationship. $\frac{D}{\sigma d}$ was not significant, for the two tests. See Table V.

[3] H. E. Garrett, *op. cit.*, pp. 269–270.

[4] Catherine Snell, "Physical Education Knowledge Tests," RESEARCH QUARTERLY, VI: 3 (October, 1935), VII: 2 (May, 1936).

TABLE V

COMPREHENSIVE TENNIS KNOWLEDGE TEST VS. MINNESOTA TENNIS KNOWLEDGE TEST

	Range	Mean	S.D.	N	σm	σd	$\frac{D}{\sigma d}$	r	P.E.
Minnesota Tennis Test	0—88	39.125	20.48	54	2.66	3.85	1.56	$r=.808$	$\pm.084$
Comprehensive Tennis Test	0—78	33.130	19.54	54	2.79				

TABLE VI

SPEARMAN BROWN-PROPHECY FORMULA FOR RELIABILITY OF COMPREHENSIVE TENNIS KNOWLEDGE TEST

	N	50 Questions	100 Questions
Odds vs. Evens	105	$r = .900$	$r = .947$

KNOWLEDGE AND PLAYING ABILITY RELATED

Knowledge test scores were correlated with the number of years each student had had experience in playing tennis. Estimates for the number of years played were given by each student. This was correlated with 54 test scores made on the Comprehensive Tennis Knowledge Test. Pearson's Product Moment $r = .656 \mp .053$. See Table VII.

TABLE VII

RELATION BETWEEN COMPREHENSIVE TENNIS KNOWLEDGE SCORES AND YEARS PLAYING EXPERIENCE

	Range	Mean	N	S.D.	r	P.E.
Comprehensive Knowledge Test	0—78	33.130	54	20.48	$r=.656$	$\mp.053$
Years Playing Experience	0—10	2.69	54	4.130		

As a means of securing more accurate data than approximate number of years playing experience, the same 54 students were given the Dyer's Backboard Tennis Test of Playing Ability.[5] According to Dyer, this test has been proved conclusively to correlate highly with tennis ability. Pearson's Product Moment r gave a correlation of $r = .939 \pm .080$. See Table VIII. Such a high correlation shows that the Comprehensive Knowledge Test scores could be used to classify individuals roughly at the start of the term into the three instructional groups—beginners, intermediates, and the advanced. See Table IX.

SUMMARY

1. Comprehensive Tennis Knowledge Test correlates highly with the Dyer Tennis Playing Ability Test $r = .939 \mp .080$.

[5] J. T. Dyer, "The Backboard Test of Tennis Ability," RESEARCH QUARTERLY, (Supplement), VI: 1 (March, 1935), pp. 63–74.

TABLE VIII

COMPREHENSIVE TENNIS TEST VS. DYER'S BACKBOARD TENNIS TEST OF PLAYING ABILITY

	Range	Mean	S.D.	N	r	P.E.
Comprehensive Tennis Test	0— 78	33.130	20.48	54		
					$r=.939$	$\pm.080$
Dyer's Backboard Test	18—119	51.42	25.92	54		

TABLE IX

COMPARISON OF MEANS OF KNOWLEDGE TENNIS SCORES WITH YEARS OF PLAYING EXPERIENCE—105

Years	0	1	2	3	4	5	8	10
		Beginners		Intermediate			Advanced	
Range	0-21	0-28	7-59	15-45	30-53	30-50	60	63
Mean	8	18	26	37.6	43	45	60*	63†

* Two cases only.
†Three cases only.

2. The test correlates relatively high with years of playing experience $r = .656 \mp .053$. Substituting a smaller unit (months for years) the correlation is raised to $r = .886 \mp .043$. Test scores tend to rank themselves in order of years' playing experience.

3. The test is reliable for it correlates with the Minnesota Tennis Knowledge Test $r = .808 \mp .084$. Self-correlation for half the test by the Spearman-Brown Prophecy Formula is $r = .900$ and for the entire test of 100 questions $r \pm .947$. This is high enough to allow the giving of two tests, Form A and B, of 50 questions each.

4. Test is valid in that it measures tennis essentials.

5. Test is easy to administer and to score.

CONCLUSIONS

The value of the Comprehensive Tennis Knowledge test is briefly concluded:

1. Diagnoses knowledge in tennis for either men or women. This is material aid to both the instructor and pupil.

2. Shows the degree of knowledge improvement or what has actually been learned. Two forms, A and B, of 50 questions each, should be used, one given at the beginning and one at the end of the term.

3. Serves as a classifier of students into three instructional groups—the beginner, the intermediate, and the advanced. (This is supplemented by the author's short ability test.)

4. Excellent objective grading device.

COMPREHENSIVE TENNIS KNOWLEDGE TEST

Form A

By Jack E. Hewitt
Oregon State College, Corvallis

Copyrighted. Permission to use any part of this test must be granted by author. Form A or B with 50 questions or Form C with 100 questions and the grading key may be obtained from Oregon State College Book Store, Corvallis, Oregon.

Name..... Hours of Class..... Score.....

Directions.—About half of the following statements are true and about one half are false. Place a plus (+) sign before statement if true, and if the statement is partially or wholly false put (O) before the statement. Mark statements in order. Do not guess, for guessing reduces your score. Answer all questions as for a right-handed player.

1. ..... A chop stroke produces backward spin on the ball.
2. ..... One should attempt to hit a ball on the forehand drive at the level of the shoulder or eyes.
3. ..... Hitting the ball in the air before it touches the ground is called a half-volley.
4. ..... If time permits, a pause at the end of the backward swing on all drives is advisable.
5. ..... Putting top spin on the ball makes it stay in the air longer.
6. ..... The end line of the tennis court is called the back line.
7. ..... It is good tennis strategy to play through strength to weakness.
8. ..... To step on the line while serving is called a line fault.
9. ..... A "smash" is an attempt to "kill" the ball on a forehand or backhand drive from a ground bounce.
10. ..... To lob the ball in the sun is to take an unfair advantage of the opponent.
11. ..... In the backhand drive the left shoulder points towards and is at right angles to the net.
12. ..... Racket stringing can be too tight for good play.
13. ..... There are only two phases of the forehand drive—the backward swing and hitting the ball.
14. ..... In the reverse American twist serve, the ball bounces toward the opponent's right.
15. ..... "Wightman Cup" play is competition for women only in countries of England and the United States.

Scoring *R—W* *Score* .....

Directions.—Place in the parenthesis the number of the word or phrase that best completes the sentence.

16. ( ) It is good strategy in tennis to: (1) force opponent out of position, (2) drive all balls to opponent's backhand side, (3) try to rattle opponent during play, (4) play balls to opponent's baseline, (5) chop all balls.
17. ( ) In the chop stroke where the ball is hit hip high, the racket completes the follow through: (1) above head, (2) above the eyes, (3) below the eyes, (4) below the shoulders, (5) below the hips.
18. ( ) To be at the net position first is: (1) spectacular, (2) best offensive position, (3) worst offensive position, (4) best lobbing position, (5) best forehand drive position.
19. ( ) In the forehand drive, one should attempt to contact the ball: (1) in front of fore foot, (2) even with fore foot, (3) center of body, (4) even with rear foot, (5) behind rear foot.

20. ( ) The overhead volley has somewhat the same motions as the smash with: (1) more speed, (2) more cut, (3) less speed, (4) less cut, (5) more wrist action.

21. ( ) If the opponent hits to your weakness you should: (1) run around the ball and hit it on your strong side, (2) lob, (3) play off to one side so that the ball comes to your strong side, (4) make attempt to play the ball on the side it hits.

22. ( ) The best position to cover most lobs on the court is: (1) two feet from net, (2) midway between the baseline and net, (3) back of baseline, (4) alleys, (5) midway between baseline and service line.

23. ( ) Smashing is more liable to be successful at the: (1) spot one foot from net, (2) back of the service line, (3) baseline, (4) back of the service line and in alleys, (5) spot between the net and the service line.

Scoring $\frac{R-W}{N-1}$ *Score* .....

Directions.—Enumerate the names for following lines and spaces of a tennis court.

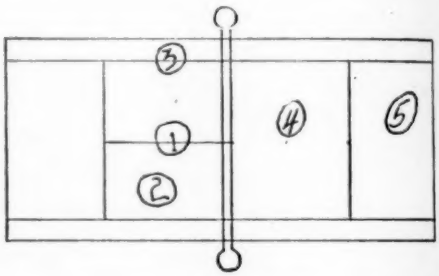
24. ..... (1)

25. ..... (2)

26. ..... (3)

27. ..... (4)

28. ..... (5)



Scoring: Number right. Score .....

Directions.—Answer the questions below by placing either "Yes" or "No" on the line before each question.

29. ..... Player A served underhand. Umpire said nothing. Was this correct?

30. ..... Player B was in such a position that he played the ball with both hands on the racket. Player A did not play the return, but claimed the point. Umpire gave Player A the point because B used two hands. Was this correct?

31. ..... Player B throws up the second ball poorly on the serve and instead of hitting the ball he catches it instead. A claims the point because B caught the ball. Was this right?

32. ..... Is the score called "game" when one side wins the additional point after deuce?

33. ..... Player F cuts the ball over the net. It has so much backspin on it that the ball bounces back into F's own court. D comes up fast to the net, but does not touch the net. He reaches over and touches the ball before it bounces a second time. F then knocks the ball out of bounds. D was given the point. Was this correct?

34. ..... In tournament play for women does winning three out of five sets determine the match?

35. ..... Player C runs close to the net and in returning the ball finds that he must jump the net to keep from touching the net. Player B, the opponent, becomes confused and knocks the ball out of the court. Umpire gave point to C. Was this correct?

36. ..... Is it permissible for your partner in a doubles game to stand in the center of the court obstructing the view of the receiver?

37. ..... If the first served ball is still in the service court, and you fail to remove it, and the second served ball hits it, is the point scored for opponent?

38. ..... In tournament play are courts changed at the end of every even game played?

39. ..... A makes good return at the net. In so doing his racket slips from his hand and into B's court. B because of this becomes confused and misses the ball. Does B get the point?

40. ..... Is the best net position midway between the service line and the baseline?

41. ..... Player C standing close to the net. Player D hits the ball close to C. Before the ball passes over the net, C reaches over the net and touches the ball with his racket. D could not return it. C, however, did not touch the net in reaching over. Was the umpire correct in giving C the point?

42. ..... Do cement courts make a faster game of tennis than grass courts?

43. ..... Player A, while serving, steps on the line simultaneously as the racket touches the ball. Is this a violation of the rules?

Scoring: Number right—number wrong. Score .....

Directions.—Match the following numbers in column *A* with the statements in column *B* to which they are related. Have no more than one number before any item in column *B*.

Column A

1. Out
2. Kill
3. Fifteen All
4. Game
5. Advantage Receiver
6. Cahill
7. Tilden
8. Smash
9. Jacobs
10. Advantage Server
11. Moody
12. Love All
13. Vines
14. Thirty All
15. Allison
16. Let
17. Chop
18. Continue play
19. Reverse ball
20. Fault
21. Footfault
22. Lenglen
23. Service Line
24. Perry
25. Lob
26. Permissible
27. Lott
28. Service
29. Deuce

Column B

44. ..... Knocking the ball over the head of the opponent.

45. ..... Ball hits net on the serve and falls into the correct service court.

46. ..... Both sides winning one point each.

47. ..... Winning point after deuce while serving.

48. ..... American man tennis player who was famous for his cannon ball service and is now a leading professional.

49. ..... Ball spinning backward to its flight.

50. ..... Any served ball hitting outside legal boundary.

Scoring: Number right. Score .....

Score Summary

1. True-False .....
2. Multiple Choice .....
3. Diagrammatic .....
4. Yes and No .....
5. Matching .....

Final Score .....

COMPREHENSIVE TENNIS KNOWLEDGE TEST

FORM B

Name..... Hour of Class..... Score.....

Directions.—About half of the following statements are true and about one half are false. Place a plus (+) sign before statement if true, and if the statement is partially or wholly false put (O) before the statement. Mark statements in order. Do not guess, for guessing reduces your score. Answer all questions as for a right handed player.

1. ..... Wimbledon, the scene of many European championships, is located in Paris.

2. ..... "Lobs" are short returns made at the net.

3. ..... Miss Helen Jacobs won the United States National Singles championship for women from Helen Wills Moody on a default.

4. ..... The English grip in the forehand drive should allow the racket face to be at right angles to the flight of the ball.

5. ..... Bringing the racket down on the ball and twisting the wrist backward produces the chop stroke.

6 ..... In the majority of instances in singles play, one should return behind the center of the baseline after each play made behind or around the baseline.

7. ..... In the forehand drive both feet should be pointed at right angles to the net.

8. ..... Tennis, when first originated, resembled our present-day game of handball.

9. ..... In singles, when the server expects to advance to the net after making a good serve, the serve should be placed as near the center line as possible.

10. ..... Suzanne Lenglen, former European woman's champion, was beaten by Helen Wills.

11. ..... A "stop-volley" is a volley played from the baseline.

12. ..... A service that touches the net and falls into the proper service court is called a "net" ball.

13. ..... The initial movement of the body in making a forehand drive starts with the turning of the hips.

14. ..... In the American twist serve, the ball bounces toward the opponent's left.

15 ..... "Davis Cup" matches are for men only.

Scoring *R—W* *Score* .....

Directions.—Place in the parenthesis the number of the word or phrase that best completes the sentence.

16. ( ) To be most effective in doubles play requires: (1) ability to play net, (2) ability to cover back court, (3) team work, (4) ability to lob, (5) ability to smash from the baseline.

17. ( ) A person wins the set when the score stands as follows: (1) 6-5, (2) 9-8, (3) 7-6, (4) 5-0, (5) 7-5.

18. ( ) A tennis ball with a forward spin on it will: (1) continue longer in the air, (2) shoot upwards, (3) shoot downwards, (4) bounce always to the right, (5) bounce always to the left.

19. ( ) In the straight overhead American serve, the racket head completes the follow through by the: (1) right shoulder, (2) left shoulder, (3) right hip, (4) right knee, (5) left knee.

20 ( ) The best average position to return a chop stroke is to get: (1) about two feet in front of bounce, (2) about four feet in front of bounce, (3) close

to spot of bounce, (4) about three feet behind bounce, (5) about five feet behind bounce.

21. ( ) In making a smash, the best position to hit the ball is: (1) directly ahead of front foot, (2) about three feet in front of the body, (3) directly over the head, (4) about one foot behind the head, (5) about two feet behind the head.

22. ( ) Most professional or expert players in the forehand drive contact the ball as it: (1) leaves the ground on the rise, (2) reaches height of bounce, (3) as it starts to fall from height of bounce, (4) midway between height of bounce and second bounce, (5) just before it hits for second bounce.

Scoring $\frac{R—W}{N—1}$ *Score* .....

Directions.—In each statement fill in the space or spaces with the proper word.

23. Hitting a ball directly overhead with attempt "to kill" is called a .....

24. Hitting the ball on the fly before it touches the ground is called a .....

25. All balls hitting boundary lines are .....

26. Stepping on the line when serving before contacting ball is called a .....

27. Hitting the ball over the head of the opponent is called a .....

28. A cut makes the ball spin .....

29. When a ball hits the net on the serve and goes into the proper court it is called a .....

30. Hitting a ball just as it bounces off the ground when standing at the net is called a .....

31. Should a ball become broken in hitting, a ..... is called.

32. When receiving the service, one takes the ..... stance.

Scoring: Number right. Score .....

Directions.—Answer the questions below by placing either "Yes" or "No" on the line before each question.

33. ..... Is the score 30-all when each side wins three points?

34. ..... A is standing close to the net. Ball hits A's arm and returns itself over the net. Is the return good?

35. ..... Player B moves one foot off the ground while in the act of serving. Is this a violation?

36. ..... Player A serving in a singles game stands in the alleys behind the baseline. The serve was in the proper court. As it was the second serve, Player B did not play the ball and claimed a point. Was this correct?

37. ..... In tournament play for men does winning three out of five sets determine the match?

38. ..... A cuts ball. B has difficult time returning ball because of spin. Is this spin the same as produced by B making a forehand drive?

39. ..... Is the score 15-love when the server wins the first point?

40. ..... If you are standing out-of-bounds and catch the ball before it hits the ground, does the point count for you?

41. ..... A makes a weak return, B runs to the net and hits ball back over net. However, in doing so his racket follows through and hits the net. A could not return the ball and claims the point because B hit the net. Was A correct?

42. ..... If Player A and partner strike and miss a high ball that goes out-of-bounds, does team B score the point?

Scoring: Number right—number wrong. Score .....

Directions.—Match the following numbers in column *A* with the statements in column *B* to which they are related. Have no more than one number before any item in column *B*.

Column A		*Column B*
1. Basefault	15. Permissible	43. ..... When each side has won three points.
2. Volley	16. Lob	44. ..... End line of the tennis court.
3. Love All	17. Continue play	45. ..... Hitting the ball overhead with attempt to kill.
4. Let	18. Pick up	46. ..... Won National singles championship for women eight times since 1923 and lives in San Francisco, California.
5. Deuce	19. Half-volley	47. ..... Jumping off the ground with both feet before contact with ball when serving.
6. Overhead play	20. Cahill	48. ..... Striking the ball close to the net when it is leaving the ground.
7. Thirty All	21. Game	49. ..... Former young English woman tennis champion whose first name begins with "Betty".
8. End Line	22. Lott	50. ..... Winning two points in succession after deuce.
9. Fifteen All	23. Advantage Receiver	
10. Footfault	24. Nuthall	
11. Baseline	25. Jacobs	
12. Stop Volley	26. Moody	
13. Kill	27. Smash	
14. Net Ball		

Scoring: Number right. *Score* .....

Score Summary

1. True-False	.....
2. Multiple Choice	.....
3. Completion	.....
4. Yes and No	.....
5. Matching	.....
Final Score	.....

Anthropometry

A Brief Survey of the Measurement of Man—from Ancient Civilization to 1932

By Hyman Krakower, Ph.D.

Chairman, Department of Health Education,
Townsend Harris High School;
Instructor, College of the City of New York

A. ANTHROPOLOGY AND ANTHROPOMETRY

ANTHROPOLOGY is referred to as the science of man. It may be defined as that portion of systematic research (or science) which deals with the differences, and causes of the differences, in structure, in function, and in all other manifestations of mankind, according to time, variety, place, and condition. Anthropology is a study of man's variation, a study of racial anatomy, physiology and pathology.[1]

Anthropometry is a branch of anthropology, and is concerned with the measurements of the human body and of its different parts, and a discussion of the results obtained by such measurements.

The objects of anthropometry are (1) to measure as exactly as possible the structure and activities of the human body, and (2) to measure the factors of the environment with which changes in man's structure and activities are associated. The structure of man is ascertained by measuring a sufficient number of his anatomical or bodily dimensions, and his activities or functions by measuring such physiological characters as vision, hearing, and smell, and such mental characters as power of observation, capacity for sustained application, systematic memory, emotion, etc.

As all of these characters vary when subjected for a sufficiently long time to a changed environment it is important to measure the principal factors of environment (i.e., nutrition, physical exercise, education, leisure, marriage, sex conditions, etc.) of the men or groups of men we are studying. "From the data obtained from such observations, correlations between man and his environment can be ascertained, and . . . thus determine certain of the laws of human evolution, which is the ultimate object of anthropometry."[2]

The practical applications of the results of anthropometric investigations are many, among them being:

To discover the rate of growth, size and proportion at different ages.

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[1] A. Hrdlicka, "Anthropology," *American Journal of Physical Anthropology*, I (1918), p. 5.

[2] Report of the Committee of the Royal Anthropological Institute, *Anthropometric Investigation in the British Isles*, (1909), p. 4.

To determine the effect of school life, shop, factory work, and all forms of industry on the masses.

To ascertain the physical qualities best suited for public service (i.e., police, army, navy, etc.).

To determine the effect of athletics and different systems of physical training on the physique.

To determine the different characteristics of the different races.

B. CLASSIFICATION—AS TO BODY PROPORTION

No single measurement can determine the class, as to body proportion, in which an individual belongs. The following measurements may be used as a means for classification; "the total stature, the sitting stature, the total spread of the arms, the circumference of the thorax, and the weight."[3]

There are three types of individuals according to the relative development of trunk and limbs; the mesatiaceles (normal), the brachysceles, and the macrosceles. The mesatiscelous (normal) individual, is one who shows no great deviation from the accepted normal type which represents an equilibrium between the various parts constituting an organism.

In the mesatiscelous type, the sitting height (sitting stature) is slightly more than 50 per cent of the standing height (total stature), ranging from 53 to 54 per cent. The total spread of the arms is equal to the standing height, and the circumference of the thorax is equal to one-half the standing height.

The brachysceles individual is one with a long trunk (sitting height) and short legs. The total spread of the arms is less than the standing height; and the circumference of the thorax is greater than half the standing height. The body weight exceeds the normal in relation to height.

The macrosceles type has a short trunk and long legs. The total spread of the arms is greater than the standing height; and the circumference of the thorax is less than half the standing height. The body weight is less than the normal in relation to height.

Table I is a summary of the different body types.

C. HISTORY OF ANTHROPOMETRY

The history of anthropometry begins with the use of the dimensions of certain parts of the human body as the first standards of measure in an attempt to establish a canon of proportion of the human body.

1. Ancient Civilization.—

a) India and Egypt.—The mathematicians and artists of India and Egypt seem to have agreed that there must be some one part of the

[3] Maria Montessori, *Pedagogical Anthropology*, p. 69.

body whose length should be the modulus or standard of dimension for all other parts. A treatise has been found, of the ancient civilization of India, called Silpi Sastri which divided the outline of the body into 480 parts.[4]

In Egypt, during the period from the thirty-fifth to the twenty-second century B.C., the unit of measure was the length of the high priest's middle finger or the so-called finger of Saturn, dividing the body into nineteen equal segments. The ancients pictured the ideal as the heavy type of stature but this was later replaced by one lighter and less robust.[5]

TABLE I

SUMMARY—CLASSIFICATION AS TO BODY TYPES

Measurement	Mesatisceles	Brachysceles	Macrosceles
Sitting Stature	Trunk slightly more than 50 per cent of body weight—from 53 to 54	Long trunk and broad; short legs	Short trunk and narrow; long legs
Spread of Arms	Equal to total stature	Less than total stature	Greater than total stature
Circumference of Thorax	Equal to one-half the total stature	Greater than one-half the total stature	Less than one-half the total stature
Weight	Normal in relation to height	Greater than normal in relation to height	Less than normal in relation to height

b) *Greece.*—Five hundred years before Christ, the Argive sculptors of Ancient Greece searched the fragmentary remains of the Egyptian wall paintings for a unit on which to construct the perfect, godlike man. Phidias is said to have used twenty models in order that he might assemble the most beautiful parts of each into one figure.[6]

Polycletus, a fellow student of Phidias, after careful study constructed a bronze statue called the Doryphoros or Spear Thrower. Many students flocked to Argos to see this broad-shouldered, thick-set, and square-chested youth stepping forward with his spear over his shoulder, the unsurpassable ideal of manly beauty. Here was pictured the athlete and fighter, his neck thick and column-like, with a long body, and a deep chest. The sturdy legs were built to withstand the fatigue of the long march in heavy armor, the brawny arms fit to wield with tireless skill the spear, the sword, and the shield.

For almost one hundred years this canon or law of physical perfec-

[4] E. Hitchcock, "Method of Physical Measurement," *American Association for the Advancement of Physical Education*, (1886).

[5] R. T. McKenzie, "The Quest for Eldorado," *American Physical Education Review*, XVIII (May, 1913), pp. 296–7.

[6] B. T. Baldwin, "Physical Growth and School Progress," *U. S. Bureau of Education Bulletin*, No. 10 (1914), p. 142.

tion was undisputed and widely copied, but as the arts of civilization became more gentle the desire for a more slender type became greater. The scenes of the palestra replaced the fields of war. It was grace rather than strength that began to appeal to the Greek.

Lysippas modeled a canon of a standing youth called Apoxyomenos. He is shown with a strigil, with which he is scraping from his smooth, lithe body the dust and dirt gotten from rolling in the soft earth of the palestra. He does not have the solidity of the earlier spear thrower, but rather a light and graceful form. The change in the Greek ideal from strength and power to grace and skill is illustrated in the long legs and neck and the small round head. The canon represented a passing from the pioneer struggle for national existence in which brute force was dominant, to the keener and more intellectual conflict of a closer community life.

The same evolution had taken place in Egypt hundreds of years before and "that same change has taken place in our modern conception of the perfect man during the last twenty-five years."[7] The peril of all civilization, including our own, is high specialization and physical decadence. With the fall of Greece from these causes, the record of the two most efficient types of their day disappeared. So great an impress did they leave on the thought of the world, that the search for the laws of physical perfection has been carried on ever since.

According to Larned, "The Athenian Greek was the most perfect natural man that history records; certainly the most consummate physical being the world has known, and in his education, the care and development of the body came first."[8]

2. From 1500 to 1860.—

About 1528, the German artist Albert Durer, of Nuremberg, worked on a canon of proportion, considering the total height to be unity. "The length of foot was one-sixth of this total, the head one-seventh, etc."[9]

The early efforts in the field of modern anthropometry are described by Baldwin.[10] In 1770 Sir Joshua Reynolds delivered an address before the Royal Academy of Fine Arts, calling attention to the differences in the measurements of the human form from childhood to adult life.

M. Quetelet is credited with coining the word anthropometry, and with making the first scientific study of physical growth. In 1835, Quetelet published his admirable work *Man and the Development of his Faculties; or, An Essay Upon Social Physics,* in four volumes, the first two of which are devoted to the physical qualities of man, the third to his moral and intellectual qualities, and the fourth treats of the

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[7] John F. Bovard and Frederick W. Cozens, *Tests and Measurements in Physical Education,* p. 27.

[8] C. W. Larned, "Athletics in History and Education," *American Physical Education Review,* XIV (Jan., 1909), p. 37.

[9] Jay W. Seaver, *Anthropometry and Physical Examination,* pp. 9–10.

[10] Baldwin, *op. cit.,* p. 142.

properties of the average man, and of the social system. "The author considers, first, the determination of the average man in general; second, with respect to physical qualities. He then proceeds to examine all that relates to the life of man; his birth, death, strength, height, agility, etc."[11]

About 1854, the physiologist Carus of Dresden conceived the vertebral column to be the unit of measure and this he divided into twenty-four parts, according to the number of vertebrae, assigning to each the same value.

The first important investigation on the physical measurements of adolescent boys was that of Zeissing in his study of Belgian children, published in 1854. In 1860, Cromwell studied the growth of Manchester school children for the ages from 8 to 18, and discovered the general law that girls are taller and heavier than boys from the approximate ages of 11 to 14. The boys then become taller and heavier and continue their growth longer.

3. *From 1861 to 1932.*—

As our mode of living differs radically from that of the Greeks, our type should also differ from theirs. "It is to the fifty years of continuously kept measurements (from 1861) taken at Amherst, we must look for a record of the physique of the young American and it is from Hitchcock and Phillips that we can claim authority to say that the great revival of physical education and outdoor life . . . has added an inch to the height of the modern student and increased his weight three pounds . . ."[12]

At first, Hitchcock measured only age, height, weight, and girths of chest, arm, and forearm and the strength of the upper arm as measured by the pull-up. Later, he adopted the list of measurements as recommended by the American Association for the Advancement of Physical Education, over fifty in number.

"The Society of Directors of Physical Education in Colleges has sought, in the average proportions of 400 picked athletes, a statute whose measurements would represent the ideal American student athlete. His proportions follow closely the 65 per cent line on a college student's chart and his type comes about midway between the two extreme ideals of beauty held up to the sculptors of Greece, the thick-set, powerful warrior, and the graceful, agile athlete."[13]

Table II is a chronological compilation of the major events in the field of anthropometry from 1870 to 1932 (in intervals of five years), as based on the works of Baldwin,[14] Bovard and Cozens,[15] McKenzie,[16]

[11] "Eulogy on Quetelet," *Annual Report of the Board of Regents of the Smithsonian Institution* (1874), pp. 180–1.

[12] R. T. McKenzie, "The Quest for Eldorado," *American Physical Education Review*, XVIII (May, 1913), pp. 300–1.

[13] R. T. McKenzie, *op. cit.*, pp. 300–1.

[14] Bird T. Baldwin, *The Physical Growth of Children from Birth to Maturity*, pp. 320–402.

[15] Bovard and Cozens, *op. cit.*, pp. 28–30.

[16] McKenzie, *op. cit.*, pp. 300–1.

Seaver,[17] and original sources. (Note: No claim whatsoever is being made by the writer that the entire field has been covered.)

TABLE II

MAJOR EVENTS IN THE FIELD OF ANTHROPOMETRY—1870 to 1932

Date	Name	Topic
1870–1874	Beddoe	A pioneer study of physical development; a study of stature and bulk of man.
	Street, G. C.	The first to use the weight-height index as an expression of robustness of an individual.
1875–1879	Bowditch, H. P.	Supplemented and improved the work done by Street. Extensive investigation of 24,000 school children as to height and weight.
	English Anthropometric Committee	Report on Military and Naval Colleges, based on 29,405 males and females. The final report was published in 1883.
	Hertel, A.	Relation of disease to growth. Investigation included 17,595 boys and 11,646 girls (Denmark).
	Peckham, C. W.	Rate of growth of approximately 10,000 school children.
	Provost General	Statistics of 190,621 male whites, from 16 to 42 years of age in the United States Army.
	Roberts, C.	Text on anthropometry which gives in index columns and result columns conclusions based on 27,640 males from the records of Bowditch, and also comparative measurements on 59,077 males (England).
1880–1884	Camerer, W.	Made a detailed study of infant growth.
	Galton, F.	Among his many contributions was the building of an anthropological laboratory to show the public the methods by which the physical characteristics may be measured and recorded (England).
	Sargent, D. A.	Began the systematic measurement of Harvard students. Made many anthropometric studies (approximately 30 years), and developed new anthropometrical instruments.
	Tarbell, A.	A pioneer study on the height, weight and relative growth of feeble-minded children.

[17] Seaver, *op. cit.*, pp. 13–15.

Date	Name	Topic
1885–1889	Geissler, A.	The heights of 21,173 children were taken for the purpose of fitting school desks (Germany).
	Hitchcock, E. and Anderson, W. G.	A comprehensive summary of what measurements should be taken and how they should be done, including detailed methods, tests, and a discussion of the conditions of the body.
	Key, A.	Study of height and weight from the age of 6 to 20 years; 18,000 children were measured (Sweden).
	Landsberger	A study of consecutive measurements of 37 children between the ages of 6 and 13; also a report of growth of 104 children through a period of seven years, from 6 to 13 years (German and Polish).
	Wylie, A. R. T.	A study of the height and weight of feeble-minded children, with the conclusion that they are subnormal in height and weight.
1890–1894	Gulick, L.	Wrote a handbook on how to take measurements.
	Hanna, D.	Anthropometric tables compiled from the measurements of 1600 college women.
	Hartwell, E. M.	A summary and references on anthropometry.
	Wiener, C.	Monograph containing curves and tables giving the annual measurements in height, weight, and head growth of his four sons from birth to maturity.
1895–1899	Bertillon, A.	Theory and practice of anthropometrical identification (France).
	Burk, F.	Influence of exercise upon growth.
	Curtiss, F. H.	Loss of weight and gain in height during sleep.
1900–1904	Boas, F.	Many works on anthropometry; among them, the relation of physical growth to education.
	Hasting, W. W.	Manual for measuring growth of the human body from 5 to 21 years of age.
	Manouvrier, L.	Classification of individuals into types as to body proportions.
	Wissler, C.	Study of growth based on correlation of increments of growth in height and weight for 72 boys for the periods from 12 to 17 years of age.

Date	Name	Topic
1905–1909	Crampton, C. W.	Draws the conclusion that there is no marked primary relationship between scholarship and weight, height, strength, etc.
	Hall, G. S.	A comprehensive treatise on adolescence, its psychology, and its relation to anthropology.
	Seaver, J. W.	Published a valuable anthropometrical text called *Anthropometry and Physical Examination.*
1910–1914	Baldwin, B. T.	An extensive series of measurements at yearly and half-yearly intervals of 861 boys and 1063 girls. Consecutive records of the same individual for periods of from 3 to 12 years. (Many other studies were made, among them being studies on the physical growth of children).
	Downes, R. M.	The interrelationship of some trunk measurements and their relation to stature.
	International Committee	International agreement for the unification of anthropometrical measurements on the living.
	King, I.	Made a study of his two sons; one between birth and six years, and the other for the first three years; sixteen measurements being taken.
	Montessori, M.	A general exposition of the history and facts of anthropometry; also, physical index dependent upon the relation of sitting height to standing height (Italy).
1915–1919	Benedict, F. G.	A photographic method of measuring the surface of the human body.
	Courtis, S. A.	Children who are poorly developed physically are also dull mentally, and that physical exercise will accelerate mental development.
	Hoffman, F. L.	Army anthropometry and medical rejection statistics.
	Holt, L. E.	Review of work done in the field of growth and nutrition.
	Hrdlička, A.	Historical review of American physical anthropology.
	Kerr, J.	Seasonal variations and values of physical training.
	Matthias, E.	Conclusion that exercise stimulates growth (Swiss).

Date	Name	Topic
	Orum, H. P. T.	Discussion of mathematical treatment of statistics of physical measurements (Denmark).
	Pearson, K. and Bell, J.	A study of the long bones. Pearson conducted many other investigations (previous dates), among them being to determine the relationship of intelligence to size of head, none being found (England).
	Pirquet, C. F.	Relationship of weight to sitting height and as an index of nutritional condition.
	Poulton, E. P.	Relationship between body weight and body length.
	Pyle, W. H. and Collings, P. E.	Comparison of country and city children, showing little difference in development.
	Robertson, T. B.	The variability of weight and stature of school children and its relationship to their physical welfare.
	Schlesinger, E.	Conducted a study similar to that of Stiles and Wheeler, and obtained the same results. In another study, the effect of war conditions upon physical growth were very slight, weight and general constitution being affected (Germany).
	Stiles, C. W. and Wheeler, G. A.	Height and weight of children in good and poor homes, those in the better class were taller and heavier.
	Urick, A. L.	Report on height and weight, comparing rural and urban children.
	Walker, E. W. A.	Relationship between body weight and length of body (England).
	Whipple, G. M.	Manual of mental and physical tests; rules for conducting of tests and treatment of measures.
	Whyte, G. D.	Establishment of height-weight norms for Chinese (China).
	Zeiner-Henrikson, K.	Growth of school children (Norway).
1920–1924	Davenport, C. B.	The best index of build is the weight divided by the square of the height.
	Davenport, C. B. and Love, A. G.	Army anthropology based on observations made on draft recruits.
	Dreyer, G.	The assessment of physical fitness by correlation of vital capacity and certain measurements of the body.
	Harris, J. A.	Relationship between stature and the length of appendages in man.

Date	Name	Topic
	Hrdlička, A.	Directions for measuring according to modern technique. (Many other studies).
	Porter, W. T.	Seasonal variations in the weight of school children.
	Retan, G. M.	The standard of normal development is the relation of height and weight at a given age.
	Wilder, H. H.	A laboratory manual of anthropometry.
1925–1929	Berkson, J.	Growth changes in physical correlation; height, weight, and chest circumference.
	Boas, F.	Study of inheritance in man. Measurements of families of immigrants living in New York. (Many other studies).
	Cathcart, E. P.	The physique of women employed in industry (England).
	Franzen, R.	Physical measures of growth and nutrition.
	Jackson, C. M. and Lees, H. D.	Correlation between vital capacity and various physical measurements.
	Jones, F. W.	Measurements and landmarks in physical anthropology.
	Kretschmer, E.	Physique and character, an investigation of the nature of constitution and theory of temperament (translation).
	Wertheimer, F. I. and Hesketh, F.	Physical stature and its relation to mental capacities and peculiarities.
	Zwarg, L. E.	The influence of age, weight, and height per inch upon motor efficiency.
1930–1932	Boillin, M. L.	Determination of the interrelations between various anthropometric measurements of college women.
	Bovard, J. F. and Cozens, F. W.	A summary of anthropometric studies.
	Cozens, F. W.	A study of stature in relation to performance.
	Harris, J. A.	Measurement of man in the mass.
	Herskovits, M. J.	Normal and abnormal types.
	Merrill, M.	Relation of individual growth to average growth.
	Merrill-Palmer	Standards of physical and mental growth.
	Paterson, D. G.	Personality and physique.
	Scammon, R. E.	Measurement of the body in childhood.

SUMMARY OF CHRONOLOGICAL TABLE

In the above table, which covers the period from 1790 to 1932, the following may be seen:

There is a general tendency to shift from the height-weight table as an index of nutritional status to one that includes measurements that consider bone growth, muscle tissue, etc.

Unification of methods of measuring and items to be measured, leading to international agreements, rather than applying different methods in each country.

Standardization of forms for recording.

Establishing norms.

Studies made of relationship between stature and length of appendages.

Norms for typical college man, and others.

Texts written amplifying the field.

Studies made from birth to old age.

The effect of exercise, intelligence, environment, and seasonal variations on growth.

A Comparison of the Intelligence and Athletic Ability of College Men

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THE PROBLEM

PUBLIC opinion about school functions is conservative. Because of this fact, educators are handicapped in their efforts to introduce into their daily practices new ideas and methods of a decidedly superior nature. It is generally recognized that educational theory is many years ahead of educational practice. This conservatism is more clearly felt when any attempt is made to introduce into the curriculum new activities with new aims. In addition to this conservative public opinion, physical educators, in their endeavor to secure proper recognition for their profession, have had to combat powerful prejudices of a subtle social nature. Most of these have had to do with the old attitude of focusing attention on the "physical" side of education as contrasted with the "mind." As a concrete example of this we sometimes hear, even today, the saying, "Strong back, weak mind" which refers, as a rule, to the mental dullness or poor scholastic standing of some particular athlete or group of athletes.

This attitude no longer holds weight among the better informed. Moreover, the pendulum of thought seems to be swinging in the other direction and more and more we hear statements similar to the following: "That there should be a certain degree of positive correlation between physical fitness and scholarship can hardly be questioned, for physical fitness is the first requisite for scholarship of any degree",[1] and "all life functions depend on physical fitness; and the greater the physical fitness, the greater the potential life efficiency."[2] The newer thought, however, is still in the hypothetical state, inasmuch as we have no conclusive evidence to the effect that physical fitness and athletic ability are positively correlated with scholarship and intelligence.

During recent years there has been an increased tendency to dis-

The author wishes to express his thanks to all who helped in the conduct of this experiment and in particular to Robert Jacobs of the Washington School, Wood River, Illinois, and Victor Franks of Chicago for their invaluable aid throughout.

[1] C. D. Giauque, "An Inquiry into the Correlation Between Physical Fitness and Scholastic Standing," SUPPLEMENT TO THE RESEARCH QUARTERLY, VI (Mar., 1935), p. 269.

[2] E. B. Wellman, "The Validity of Various Tests as Measures of Motor Ability," SUPPLEMENT TO THE RESEARCH QUARTERLY, VI (Mar., 1935), p. 25.

cover, objectively, the relationship existing between these factors, with the result that we now have available for study a considerably more imposing collection of concrete and related works. The major difficulty, we find, is that what Affleck said in 1920 regarding physique and mentality holds true today for the factors of intelligence and athletic achievement, namely that, "The relationship between physique and mentality is one upon which great differences of opinion are still held. One can find experimental data supporting any attitude which may be suggested."[3]

PURPOSE OF THE STUDY

This study, then, becomes an effort on the part of the author to contribute additional data on the subject, in the hope that with the material already available and that which will be written in the future, it will help to formulate definite conclusions. The specific purpose of this investigation, therefore, is to study experimentally the relationship existing between intelligence and athletic achievement.

SOURCES OF DATA

1. Two hundred and ninety-five men between the ages of 18 and 21 of the required physical education classes of the Southern Illinois State Teachers' College acted as subjects for this experiment.

2. Intelligence quotients were determined through the medium of the Otis Self-Administering Tests of Mental Ability, Higher Examination (Form B).

3. The 295 cases were divided into "classes" for fairness in athletic competition by means of the McCloy method of classification.[4]

4. Athletic achievement scores were secured by obtaining individual records in eight events, namely, the standing broad jump, running broad jump, 100-yard dash, 440-yard dash, 12-pound shot-put, javelin throw, baseball throw for distance, and push-ups, and by transposing them into a single percentage score through the use of a specially devised scoring chart.[5]

5. Motor ability ratings were attained by using Brace's Motor Ability Tests[6] and by the further application of the McCall T-Scale technique for scaling tests in physical education.[7]

6. The rank method and foot rule formula were employed to secure the coefficient of correlation between Intelligence Quotient, Athletic

[3] G. B. Affleck, "A Minimum Set of Tentative Physical Standards for Children of School Age," *Ped. Sem.*, XXVII (1920), p. 325.

[4] C. H. McCloy, *The Measurement of Athletic Power*, (New York: A. S. Barnes and Co., 1932), pp. 96–98.

[5] See Appendix B for special rules for the events.

[6] D. K. Brace, *Measuring Motor Ability*, (New York: A. S. Barnes and Co., 1927), pp. 100–125.

[7] W. A. McCall, *How to Measure in Education*, (New York: The Macmillan Co., 1922), pp. 272–275.

TABLE I

Scoring Chart for Athletic Events
College Men

Grade	Percentage	Standing Broad Jump	Running Broad Jump	100-Yard Dash	440-Yard Dash	Javelin Throw	12-lb. Shot-Put	Baseball Throw	Push-Ups	Percentage
6.25 per cent—E	1	5–5	9–0	15.1	91	39	16–3	100	1	1
	2	5–6		15	90	40	16–6	102	2	2
	3	5–7		14.9	89	41	16–9	104		3
	4	5–8		14.8	88	42	17	106	3	4
	5			14.7	87	43	17–3	108		5
	6	5–9	10–0	14.6	86	44	17–6	110	4	6
	7			14.5	85	45	17–9	112		7
	8	5–10		14.4	84	46	18	114	5	8
	9			14.3	83	47	18–3	116		9
	10	5–11		14.2	82	48	18–6	118		10
	11		11–0	14.1	81.5	49	18–9	120		11
	12	6–0		14	81	50	19	122	6	12
	13				80.5	51	19–3	124		13
	14	6–1		13.9	80	52	19–6	126		14
	15				79.5	53	19–9	128		15
	16	6–2	12–0	13.8	79	54	20	130		16
	17				78.5	55	20–3	132	7	17
	18	6–3	12–4	13.7	78	56	20–6	134		18
	19				77.5	57	20–9	136		19
	20	6–4	12–8	13.6	77	58	21	138		20
	21				76.5	59	21–3	140	8	21
	22	6–5	13	13.5	76	60	21–6	142		22
	23				75.5	61	21–9	144		23
	24	6–6	13–3	13.4	75	62	22	146		24
	25				74.5	63	22–3	148		25
	26	6–7	13–6	13.3	74	64	22–6	150	9	26
	27				73.8	65	22–9	152		27
25 per cent—D	28	6–8	13–9	13.2	73.6	66	23	154		28
	29				73.4	67	23–3	156		29
	30	6–9	14	13.1	73.2	68	23–6	158	10	30
	31		14–1		73	69	23–9	160		31
	32	6–10	14–2		72.6	70	24	162		32
	33		14–3	13	72.3	71	24–3	164	11	33
	34	6–11	14–4		72	72	24–6	166		34
	35		14–5	12.9	71.8	73	24–9	168		35
	36		14–6		71.5	74	25	170	12	36
	37	7–0	14–7		71.3	75	25–3	172		37
	38		14–8	12.8	71	76	25–6	174		38
	39	7–1	14–9		70.6	77	25–9	176	13	39
	40		14–10		70.3	78	26	178		40
	41		14–11	12.7	70	79	26–3	180		41
	42	7–2	15		69.6	80	26–6	182	14	42
	43		15–1	12.6	69.3	81	26–9	184		43
	44	7–3	15–2		69	82	27	186		44
	45		15–3		68.8	83	27–3	188	15	45
	46	7–4	15–4	12.5	68.6	84	27–6	190		46
	47		15–5		68.4	85	27–9	192		47

Note: This chart may be used to determine letter grades A, B, C, D, and E. They have been secured by adhering to the accepted percentage divisions as found by the expansion of the binomial. The chart may not be used to determine number grades, since the "letters" do not correspond to the number percentage generally assigned to them.

Grade
37.5 per cent—C
25 per cent—B
6.25 per cent—A

Grade	Percentage	Standing Broad Jump	Running Broad Jump	100-Yard Dash	440-Yard Dash	Javelin Throw	12-lb. Shot-Put	Baseball Throw	Push-Ups	Percentage
	48	7–5	15–6	12.4	68.2	86	28	194	16	48
	49		15–7		68	87	28–3	196		49
	50		15–8		67.6	88	28–6	198		50
	51	7–6	15–9	12.3	67.3	89	28–9	200	17	51
	52		15–10		67	90	29	202		52
	53	7–7	15–11		66.8	91	29–3	204		53
	54		16	12.2	66.6	92	29–6	206	18	54
	55	7–8	16–1		66.4	93	29–9	208		55
	56		16–2		66.2	94	30	210		56
37.5 per cent—C	57	7–9	16–3	12.1	66	95	30–3	212		57
	58		16–4		65.6	96	30–6	214	19	58
	59	7–10	16–5		65.3	97	30–9	216		59
	60		16–6	12	65	98	31	218		60
	61	7–11	16–7		64.8	99	31–3	220	20	61
	62		16–8		64.6	100	31–6	222		62
	63		16–9	11.9	64.4	101	31–9	224		63
	64	8–0	16–10		64.2	102	32	226	21	64
	65		16–11	11.8	64	103	32–3	228		65
	66		17		63.8	104	32–6	230	22	66
	67	8–1	17–1	11.7	63.6	105	32–9	232		67
	68		17–2		63.4	106	33	234		68
	69		17–3	11.6	63.2	107	33–3	236	23	69
	70	8–2	17–4		63	108	33–6	238		70
	71		17–5	11.5	62.8	109	33–9	240	24	71
25 per cent—B	72		17–6		62.6	110	34	242		72
	73	8–3	17–7	11.4	62.4	111	34–3	244	25	73
	74		17–8		62.2	112	34–6	246		74
	75		17–9	11.3	62	113	34–9	248	26	75
	76	8–4	17–10		61.9	114	35	250		76
	77		17–11	11.2	61.8	115	35–3	252	27	77
	78		18		61.7	116	35–6	254		78
	79	8–6	18–1	11.1	61.6	117	35–9	256	28	79
	80		18–2		61.5	118	36	258		80
	81		18–3	11	61.4	119	36–3	260	29	81
	82	8–7	18–4		61.3	120	36–6	262		82
	83		18–5	10.9	61.2	121	36–9	264	30	83
	84	8–8	18–6		61.1	122	37	266		84
	85		18–7	10.8	61	123	37–3	268	31	85
	86	8–9	18–8		60.8	124	37–6	270		86
	87		18–9	10.7	60.6	125	37–9	272	32	87
	88	8–10	18–10		60.4	126	38	274		88
	89		18–11	10.6	60.2	127	38–3	276	33	89
	90	8–11	19		60	128	38–6	278		90
6.25 per cent—A	91		19–2	10.5	59.9	129	38–9	280	34	91
	92	9–0	19–4		59.8	130	39	282		92
	93		19–6	10.4	59.7	131	39–3	284	35	93
	94	9–1	19–8		59.6	132	39–6	286		94
	95		19–10	10.3	59.5	133	39–9	288	36	95
	96	9–2	20		59.4	134	40	290		96
	97		20–1	10.2	59.3	136	40–3	292	37	97
	98	9–3	20–2		59.2	138	40–6	294	38	98
	99		20–3	10.1	59.1	140	40–9	296	39	99
	100	9–4	20–4	10	59	142	41	298	40	100

Achievement, and Motor Ability within the various athletic classes, and conclusions are derived from the findings.[8]

TESTING AND SCALING PROCEDURES

1. The intelligence quotients, determined as described above, need no explanation here.[9]

2. The ages, heights, and weights of the men were recorded to the nearest year, inch, and pound. These factors determined the individual's athletic classification or "Index" by using McCloy's formula and table for college range which are as follows:[10]

6H (height in inches) + W (weight in pounds)
College Range 490–600

Class	For a small group
A	570 and over
B	550
C	530
D	529 and under

3. Case records in the eight athletic events were converted into percentage points through the use of the Scoring Table for Athletic Events, shown on pages 98–99, and averaged to obtain individual athletic achievement scores.

In the construction of this chart, considerable effort has been spent to insure its scientific soundness. Scores in the eight events were arranged side by side, and the percentage divisions were roughly evened. Keeping this agreement as nearly as possible between percentage groups of each event, the nearest possible natural arrangement of scores in each event was worked out. If the two conflicted, natural arrangement was sacrificed in some slight measure for agreement of percentage divisions. In some cases the score equal to 100 per cent is less than the highest record in that event. In such instances the demands of both group agreement and natural arrangement indicated that a somewhat lower score was more suitable.

4. Brace's Motor Ability Tests were administered and scored.[11] The lack of a T-scale scoring chart for men of college age necessitated the construction of the table indicated below. The methods employed in

[8] H. O. Rugg, *Statistical Methods Applied to Education*, (New York: Houghton Mifflin Co., 1917), pp. 288–291.

[9] World Book Company, Chicago and Yonkers-on-Hudson, N. Y., 1922.

[10] C. H. McCloy, *loc. cit.*

[11] D. K. Brace, *Measuring Motor Ability*, (New York: A. S. Barnes and Co., 1927), pp. 100–125. The original Brace tests have been used throughout this experiment inasmuch as a goodly number of the cases had been examined prior to Brace's revision of 1932.

the construction of this table are identical to those used by Brace[12] and McCall.[13]

TABLE II

TABLE FOR CONVERTING TEST SCORES INTO SCALE SCORES FOR COLLEGE MEN AGES 18–21

Score (Tests Passed)	T-Scale Score	Score (Tests Passed)	T-Scale Score
7	21	14	48
8	24	15	52
9	29	16	56
10	34	17	60
11	37	18	65
12	39	19	69
13	44	20	80

TABLE III

RESULTS OF THE TESTS
CORRELATION OF I.Q. AND A.A.

Athletic Class	Number of Cases	Correlation r
A	107	—.20
B	78	—.10
C	63	.22
D	42	.10
A+B+C+D	290	.08

TABLE IV

CORRELATION OF OTHER FACTORS

Factors Correlated	Number of Cases	Correlation r
Age and A.A.	295	.03
Height and A.A.	295	.04
Weight and A.A.	295	.28
Height and Weight	295	.55
Motor Ability and A.A.	278	.31
Motor Ability and I.Q..	275	.07

CONCLUSIONS

Findings in this experiment seem to indicate that:

1. There is no definite correlation between intelligence and athletic ability, and intelligence and motor ability in college men. This may be interpreted to mean that regardless of a college man's I.Q. he may be a "good, bad, or indifferent" athlete. Vice versa, regardless of a college

[12] *Ibid.*, pp. 66–72.
[13] W. A. McCall, *loc. cit.*

man's athletic attainments he may fall anywhere in an I.Q. rating scale. One cannot be determined by the other.

2. There is a small but definite correlation (.31) between motor ability and athletic achievement which substantiates the findings of others.[14]

3. Between the years 18–21, age and height have no bearing on general athletic achievement, but weight has a definite, although low correlation (.28).

McCloy, discussing athletic classification and handicapping by age, height, and weight states, "the performance should, theoretically, vary directly with increase in weight. Increase in height should have little influence unless there should be an excess of force over the amount that can be used, up to the limit of contraction time."[15] However, as the result of various experiments he further states, "Chronological age is an important contributing factor up to and including the age of seventeen. Beyond that age it does not seem to be significant when allowance is made for height and weight . . . . Above the age of fourteen, height is more significant than either age or weight. . . . Weight is of great significance at ages of fourteen and below, and of relatively less significance above this age."[16]

An examination of the above statements indicates that there is close agreement between the findings in this study and McCloy's theoretical views as to the relative importance of age, height, and weight as factors in athletic achievement. The chief difference between the results tabulated above and McCloy's conclusions as based on actual experimentation is in the matter of height. This may or may not be somewhat accounted for by the fact that McCloy's study was based on an age group between 16–18, where as in this experiment the 18–21 age group was used.

4. This investigation was conducted as an effort on the part of the author to contribute additional data on the subject, in the hope that with the material already available and that which will be written in the future, it will help to formulate definite conclusions. All conclusions are therefore necessarily tentative in character.

OBSERVATIONS

It is accepted by physical educators that "controlled" experiments of this type involve too many variables such as track and weather conditions, change in daily condition of the subjects, influence of time of day on performance, and others which it is needless to enumerate in

[14] R. N. Hoskins, "The Relationship of Measurements of General Motor Capacity to the Learning of Specific Psycho-Motor Skills," THE RESEARCH QUARTERLY, V (March, 1934), pp. 70–71.
D. K. Brace, *op. cit.*

[15] C. H. McCloy, *op. cit.*, p. 67.

[16] *Ibid.*, pp. 94–95.

detail here.[18] A determined effort was made in this experiment to control in part a number of these influencing factors. The impracticability and impossibility of controlling all of them is very evident. Any one factor, then, is likely to affect the results.

We are aware that intelligence is exercised in the analysis of a skilled movement. The more complex, the more interpretive the movement, the greater the amount of intelligence necessary to comprehend it. Educability in such case is dependent on practice in the movement, and the greater the intelligence, the greater the possibility for educability. Intelligence in athletics is also exercised in the strategy involved in the various games, such as in quarterbacking in football, a pitcher outguessing the batter, or the batter crossing up the fielders in baseball, etc. Given a series of athletic tests, administered under the same conditions and with all other factors influencing athletic achievement the same to two individuals identical in physique but differing in intellect, it is reasonable to believe that the more intellectual will prove superior. The assumption then is that intelligence does play a part in athletic achievement.

In view of the many influencing factors involved in this experiment it would seem that at best a correlation between intelligence and athletic achievement would necessarily be small in nature. The fact that the results obtained indicate that there is no definite correlation between the two factors does not necessarily mean that a correlation does not exist between them, but rather that the proof of such a relationship awaits the results of more refined and elaborate investigation.

APPENDIX A

Table of Individual Records

This consists of 296 individual records for age, height, weight, athletic class, standing broad jump, running broad jump, 100-yard dash, 440-yard dash, 12-pound shot-put, javelin throw, baseball throw for distance, push-ups, I.Q., athletic achievement score, and motor ability score.

APPENDIX B

The Athletic Events and Special Rules

1. *Standing broad jump.*—Three jumps allowed each contestant, the best jump of the three being scored.

2. *Running broad jump.*—Three jumps allowed each contestant, the best jump

[18] An example of the multiplicity of these variables is the list quoted by N. P. Neilson and F. W. Cozens: "A list of the advantage and handicapping factors influencing performance in physical education activities would undoubtedly include such items as race, sex, chronological age, physiological age, grade in school, intelligence, weight, height, length of trunk, length of arms, length of legs, width of shoulders, width of hips, depth of chest, chest expansion, vital capacity, blood pressure, pulse rate, muscle tonus, nerve force, neuromuscular coordination, reaction time, strength, energy, speed, endurance, agility, courage, attitude, determination, interest, and experience. These factors are, of course, not mutually exclusive." "Achievement Scales in Physical Education Activities for Boys and Girls in Elementary and Junior High Schools," The Research Quarterly, V (October, 1934), p. 4.

of the three being scored. The jump is measured from the toe at the "take-off" to the heel in landing.

3. *100-yard dash.*—One trial only allowed.

4. *440-yard dash.*—One trial only allowed.

5. *12-pound shot-put.*—Three puts allowed, the best put of the three being scored. The toe-board is disregarded, and the put is measured from the toe, or hand, if it strikes the ground in front of the toe, to the inner edge of the break in the ground.

6. *Javelin throw.*—Three throws allowed, the best throw being scored. The same technique of measuring is used here as in the shot-put.

7. *Baseball throw for distance.*—Same technique of measuring is used here as in the javelin throw and the shot-put.

8. *Push-ups.*—From a front leaning rest position (hands on floor, shoulder width apart, legs extended to the rear, supporting the body on the arms and toes, arms straight, body in one straight line from head to heels), bend the arms until the chest touches the floor and return to starting position. The number of times this is repeated with proper form determines the score.

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A Comparative Study of Physical Education Programs for Senior High School Girls and Boys

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INTRODUCTION

THE value of physical education as a method by means of which important contributions are made to the growth—physical, mental, social, and cultural—of girls and boys is being recognized today by those school administrators who have carefully analyzed the desirable outcomes of the school curriculum, and have organized and are administering their programs in the interest of the attainment of these outcomes.

Recent social changes and their implications have brought about painstaking analyses of aims, methods of procedures, content, and measurement of results, especially in the newer subjects in education. It is interesting to note that in many cases, in the light of these careful studies, some of the traditional subjects or courses are being shifted to the category of so-called "frills," and the latter to a more prominent place in the curriculum.

Another result of this re-evaluation of curricular offerings is seen in the emphasis given by some teachers of physical education to differentiated programs for girls and boys. While this discrimination of programs is in its infancy, there are encouraging signs throughout the country as a whole. One need but mention the physical contrasts between senior high school girls and boys to appreciate the importance of a curriculum in physical education which is so differentiated in content and emphasis as to meet the needs of each. While the same qualities may be desirable in both cases, surely the degree of emphasis is often quite different. For example, it probably would be rather generally conceded that it is desirable to develop muscular strength in boys to a greater degree than in girls, while the reverse might be true in the matter of sympathy, poise, grace, charm, and the like.

Likewise, careful consideration should be given to an analysis of the desirable social and cultural qualities which are attainable through physical activities. Physical education teachers should know definitely the desirable outcomes of out-of-school life activities or values which they plan to achieve through the school's curriculum, and these should be clearly and separately stated for girls and for boys.

THE PROBLEM

The specific problem of this research may be stated in the question, To what extent are physical education programs for senior high school girls and boys differentiated as to aims, methods, activities, and the measurement of results?

Basically, the investigation is an attempt to study the physical education programs of high schools in cities throughout the United States having a population of from ten to twenty thousand, to compare those for girls and for boys, and to determine to what extent, if any, those for girls are an imitation of those for boys.

THE PROCEDURE

A random selection of cities of this size was made for each state, and to the high school principals of these cities was sent a series of questions whose answers would indicate whether and to what degree girls' programs differ from those for boys.

The following questionnaire was sent to each of the 170 schools selected.

QUESTIONNAIRE

I. Objectives.—(The following have been chosen carefully to avoid overlapping.)

Please mark "3" those objectives for the attainment of which your physical education programs are especially designed; mark "2" those to which your programs are partly adapted; mark "1" those objectives your program serves incidentally but not at all importantly.

A. Physical	Girls	Boys
Organic soundness		
Muscular strength		
Posture		
Poise		
Grace		
Voice		
Neuromuscular skills		
Elimination of physical defects		
B. Social		
Initiative		
Courage		
Self-control		
Perseverance		
Honesty		
Justice		
Courtesy		
Sympathy		
Cooperation		
Loyalty		

C. Cultural

Rhythm
Music
Nature
Human nature
Natural science
Social science
The arts

II. Procedures Used to Achieve Objectives.—

A. Are your physical education programs differentiated to meet the physical and health-habit needs *of girls?* Yes. No. *Of boys?* Yes. No.

B. In those activities in which there is varsity competition, please designate the approximate number of games played each year.

	Girls	Boys
Archery		
Hard baseball		
Soft baseball		
Basketball		
Boxing		
Cross country		
Field hockey		
Football		
Golf		
Handball		
Horseback riding		
Soccer		
Swimming		
Tennis		
Track and field events (please list)		
Volleyball		
Winter sports (please list)		
Wrestling		
Others (please list)		

C. Please check the activities which are organized on the intramural plan.

	Girls	Boys
Archery		
Hard baseball		
Soft baseball		
Basketball		
Boxing		
Cross country		
Field hockey		
Football		
Golf		
Horseback riding		
Soccer		

Swimming
Tennis
Track and field events
Wrestling
Others (please list)

D. Please list the activities in which tournaments are held.

E. Does your school participate in playdays or sports days *for girls?* Yes. No. *For boys?* Yes. No.

F. Do you provide for equality between teams *for girls?* Yes. No. *For boys?* Yes. No. If so, please list the activities for which such provision is made, and indicate the method used to secure equality in each case.

Girls		Boys	
Activity	Method	Activity	Method

G. Please check (√) the activities which are pupil organized; check (√√) those which are pupil managed; and (√√√) those which are both organized and managed by pupils under supervision.

	Girls	Boys
Archery		
Hard baseball		
Soft baseball		
Basketball		
Field hockey		
Football		
Golf		
Handball		
Soccer		
Swimming		
Tennis		
Track and field events		
Volleyball		
Winter sports (please list)		
Others (please list)		

III. Program of Activities.—

In order to discover the extent to which the following activities are used, please designate the approximate amount of school time per week devoted to each, striking an average for the entire year.

	Girls	Boys
Boxing		
Calisthenics		
Folk and national dancing		
Interpretative and natural dancing		
Social dancing		
Games—individual, couple, and group games of low organization		
Games—team games of high organization (athletics)		

Heavy apparatus
Hiking
Self-testing stunts and tumbling
Swimming
Winter sports (please list)
Wrestling
Others (please list)

IV. Measurement.—

Please check such of the following as are used in measuring the results of your physical education program.

	Girls	Boys
Annual medical examination		
Annual physical examination		
Skill and information tests		
Physical fitness index		
Strength index		
Others (please list)		

Signature
Official position
Address

One hundred two replies were received from 44 of the 47 states to which these questionnaires went. Of this number 13 stated that the school offered no physical education program, 21 checked carefully only the girls' and 4 only the boys' programs, 1 included the first two years of college, while 5 were too incomplete to be included in this summary.

This investigation, therefore, concerns itself with the information obtained from 58 very carefully checked questionnaires from all sections of the United States.

Following is a summary of the information presented in the questionnaires. In each case the similarity between the girls' and boys' programs is noted as well as the extent to which each item is given prominence in the physical education curriculums.

I. Objectives.—

A. Physical.—Figure I shows the approximate degree of similarity between the physical objectives of the physical education programs for girls and boys.

There are 13 cases in which the same physical objectives were listed for both boys and girls. In 45 cases there were one or more differences, in all 136 specific differences.

B. Social.—Figure II shows the approximate degree of similarity between the social objectives of the physical education programs for girls and boys.

In 23 cases the same social objectives are listed for both boys and girls. There were one or more differences in 35 cases, in all 129 specific differences.

FIGURE I

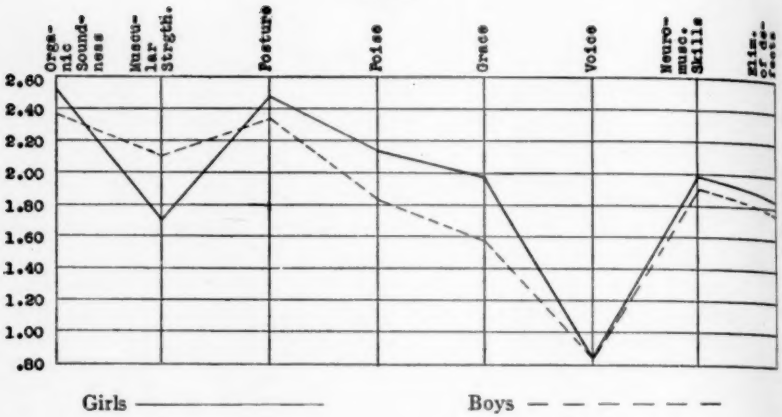


FIGURE II

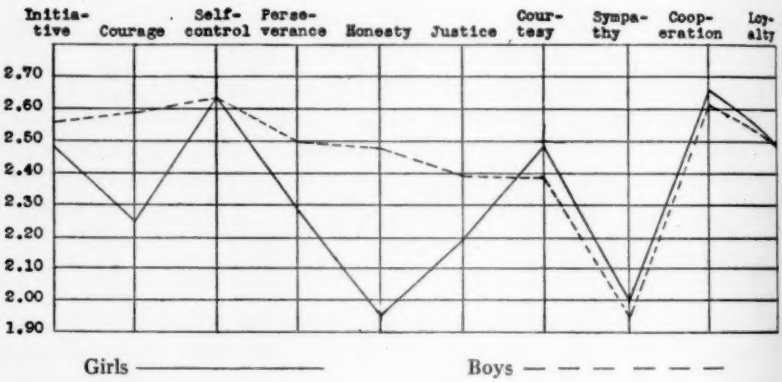
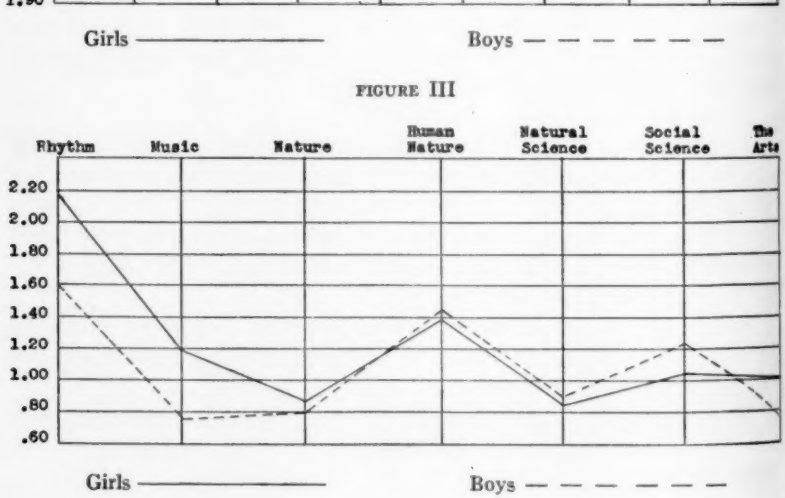


FIGURE III



C. Cultural.—Figure III shows the approximate degree of similarity between the cultural objectives of the physical education programs for girls and boys.

There are 18 cases in which the same cultural objectives were listed for both boys and girls. In 40 cases there were one or more differences, in all 108 specific differences.

II. Procedures.—

A. Are your physical education programs differentiated to meet the physical and health-habit needs?

51 answers for girls: Yes, 43; No, 8.

50 answers for boys: Yes, 41; No, 9.

In 7 cases, or 12 per cent of the schools, there was no differentiation for either girls or boys.

In 40 cases, or 69 per cent of the schools, there was differentiation for both girls and boys.

B. In those activities in which there is varsity competition, please designate the approximate number of games played each year.

Note: In so many instances the number of girls and boys participat-

TABLE I

	Number of schools using activity		Per cent of schools using activity		Per cent of similarity of girls and boys activities
	Girls	Boys	Girls	Boys	
Archery	2	2	3.0	3.0	100.0
Basketball	23	55	39.6	94.8	41.8
Boxing	0	8	0.0	13.8	0.0
Cross country	0	12	0.0	20.7	0.0
Field ball	2	0	2.0	0.0	0.0
Field hockey	7	2	12.0	3.0	25.0
Football	1	52	1.7	89.6	1.9
Golf	1	20	1.7	34.0	5.0
Handball	0	3	0.0	5.1	0.0
Hard baseball	1	17	1.7	29.0	5.9
Hiking	1	0	1.7	0.0	0.0
Horseback riding	2	2	3.0	3.0	100.0
Ice hockey	2	4	3.0	6.9	44.1
Ice skating	1	2	1.7	3.0	56.6
Lacrosse	0	1	0.0	1.7	0.0
Roller skating	1	0	1.7	0.0	0.0
Skiing	1	2	1.7	3.0	56.6
Snow shoeing	0	1	0.0	1.7	0.0
Soccer	14	6	24.0	10.3	43.3
Soft baseball	12	14	20.7	24.0	82.0
Swimming	3	7	5.1	12.0	42.5
Tennis	16	38	27.6	65.5	42.1
Track	4	36	6.9	62.0	89.8
Volleyball	8	5	13.8	8.6	55.0
Whit tennis	1	0	1.7	0.0	0.0
Wrestling	0	8	0.0	13.8	0.0

Total number of activities 26
Total number of activities for girls 20
Total number of activities for boys 22

ing was given rather than the number of games played, that the summary in Table I on page 113 merely gives the activities in which there is varsity competition.

C. Please check the activities which are organized on the intramural plan.

TABLE II

	Number of schools using activity		Per cent of schools using activity		Per cent of similarity of girls and boys activities
	Girls	Boys	Girls	Boys	
Archery	7	3	12.0	5.1	42.5
Basketball	52	54	89.6	93.1	96.2
Bicycling	1	1	1.7	1.7	100.0
Bowling	1	0	1.7	0.0	0.0
Boxing	1	11	1.7	18.9	8.9
Center ball	1	0	1.7	0.0	0.0
Cross country	0	7	0.0	12.0	0.0
Field ball	4	0	6.9	0.0	0.0
Field hockey	15	3	25.8	5.1	19.7
Football	1	19	1.7	32.7	5.1
Golf	4	10	6.9	17.2	40.1
Gymnasium club	0	1	0.0	1.7	0.0
Handball	0	1	0.0	1.7	0.0
Hard baseball	2	14	3.0	24.0	12.5
Hiking	2	2	3.0	3.0	100.0
Hitball	1	0	1.7	0.0	0.0
Hit pin baseball	1	0	1.7	0.0	0.0
Horseback riding	3	2	5.1	3.0	58.8
Horseshoes	0	2	0.0	3.0	0.0
Ping pong	4	3	6.9	5.1	73.9
Soccer	15	6	25.8	10.3	39.9
Soft baseball	43	38	74.1	65.5	88.4
Speedball	2	1	3.0	1.7	56.6
Swimming	9	12	15.5	20.7	74.8
Tap dancing	1	0	1.7	0.0	0.0
Tenniquoit	1	0	1.7	0.0	0.0
Tennis	29	26	50.0	44.8	89.6
Touchdown passball	1	0	1.7	0.0	0.0
Touch football	1	5	1.7	8.6	19.7
Track	16	37	27.6	63.8	43.2
Tumbling	1	0	1.7	0.0	0.0
Volleyball	13	5	22.4	8.6	38.4
Whit tennis	1	1	1.7	1.7	100.0
Winter sports	1	1	1.7	1.7	100.0
Wrestling	0	10	0.0	17.2	0.0

Total number of activities 35
Total number of activities for girls 30
Total number of activities for boys 26

D. Please list the activities in which tournaments are held.

TABLE III

Activity	Girls	Boys	Not designated as to sex	Total
Basketball	14	20	20	54
Tennis	11	6	7	24
Volleyball	8	1	7	16
Soft baseball	4	4	4	12
Baseball	6	4	1	11
Track and field	2	8	1	11
Field hockey	6		1	7
Soccer	2	2	3	7
Ping-pong	3	1	2	6
Tenniquoit	3	1	1	5
Wrestling		4	1	5
Boxing		3	1	4
Golf		1	3	4
Horseshoe pitching		1	3	4
Speedball	1	2	1	4
Archery	2	1		3
Basketball shooting	1	1	1	3
Handball		2		2
Touch football		2		2
Badminton	1			1
Center ball	1			1
Field ball			1	1
Gymnasium relays			1	1
Hit pin baseball	1			1
Ice skating		1		1
Kitten ball			1	1
Lacrosse		1		1
Mushball			1	1
Passball		1		1
Philadelphia kick ball	1			1
Shuffleboard	1			1
Slangball	1			1
Swimming			1	1
Whit tennis			1	1
Total	69	67	63	119

E. Does your school participate in playdays or sports days for girls? For boys?

Of the 58 schools replying, 33 participate in playdays for girls, and 15 for boys, the per cent of similarity being 45.

F. Do you provide for equality between teams for girls? For boys? If so, please list the activities for which such provision is made and indicate the method used to secure equality in each case.

Thirty-six schools reported some method of securing equality for girls, and 35 for boys. The per cent of similarity in this respect is 97.

The principle of equality was reported in the following activities,

TABLE IV

	Pupil organized and managed (√√√)					Pupil managed (√√)					Pupil organized (√)				
			Per cent of schools		Similarity per cent			Per cent of schools		Similarity per cent			Per cent of schools		Similarity per cent
	G.	B.	G.	B.		G.	B.	G.	B.		G.	B.	G.	B.	
Archery	10	5	17.2	8.6	50.0	3	4	5.1	6.9	75.0	5	5	8.6	8.6	100.0
Baseball—hard	0	8	0.0	13.8	0.0	1	3	1.7	5.1	33.3	0	5	0.0	8.6	0.0
Baseball—soft	20	11	34.0	18.9	55.0	8	9	13.8	15.5	88.8	2	1	3.0	1.7	56.6
Basketball	32	22	55.2	37.9	68.6	6	4	10.3	6.9	66.9	5	9	8.6	15.5	55.5
Field hockey	9	3	15.5	5.1	32.9	3	1	5.1	1.7	33.3	1	2	1.7	3.0	56.6
Football	2	10	3.0	17.2	17.4	0	1	0.0	1.7	0.0	1	5	1.7	8.6	20.0
Golf	1	8	1.7	13.8	12.3	2	3	3.0	5.1	66.6	1	4	1.7	6.9	25.0
Handball	0	3	0.0	5.1	0.0	0	1	0.0	1.7	0.0	1	0	1.7	0.0	0.0
Soccer	6	4	10.3	6.9	66.9	2	2	3.0	3.0	100.0	2	1	3.0	1.7	56.6
Swimming	6	3	10.3	5.1	49.5	1	1	1.7	1.7	100.0	2	1	3.0	1.7	56.6
Tennis	21	14	36.2	24.0	66.3	6	6	10.3	10.3	100.0	5	7	8.6	12.0	71.4
Track	7	10	12.0	17.2	69.7	3	3	5.1	5.1	100.0	0	5	0.0	8.6	0.0
Volleyball	23	6	39.6	10.3	26.0	7	7	12.0	12.0	100.0	4	4	6.9	6.9	100.0
Bicycling	1	1	1.7	1.7	100.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Bowling	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Field ball	3	1	5.1	1.7	33.3	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0
Folk dancing	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Hiking	2	1	3.0	1.7	56.6	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Hit pin baseball	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Horseback riding	2	0	3.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0

	Pupil organized and managed (√√√)					Pupil managed (√√)					Pupil organized (√)				
			Per cent of schools		Similarity per cent			Per cent of schools		Similarity per cent			Per cent of schools		Similarity per cent
	G.	B.	G.	B.		G.	B.	G.	B.		G.	B.	G.	B.	
Horseshoes	0	1	0.0	1.7	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Ice hockey	0	1	0.0	1.7	0.0	0	0	0.0	0.0	0.0	0	1	0.0	1.7	0.0
Ice skating	3	1	5.1	1.7	33.3	0	1	0.0	1.7	0.0	1	0	1.7	0.0	0.0
Lacrosse	0	0	0.0	0.0	0.0	0	1	0.0	1.7	0.0	0	0	0.0	0.0	0.0
Passball	0	1	0.0	1.7	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Ping-pong	2	1	3.0	1.7	56.6	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Roller skating	2	0	3.0	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Skiing	2	0	3.0	0.0	0.0	0	1	0.0	1.7	0.0	0	0	0.0	0.0	0.0
Snow shoeing	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Speedball	2	1	3.0	1.7	56.6	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Tether ball	0	1	0.0	1.7	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Tobogganing	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Touch football	0	2	0.0	3.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Tumbling	2	1	3.0	1.7	56.6	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Whit tennis	1	0	1.7	0.0	0.0	0	0	0.0	0.0	0.0	0	0	0.0	0.0	0.0
Total number of activities					34					17					15
Total number of activities for girls					27					12					12
Total number of activities for boys					25					16					13
Average per cent of similarity in number of activities					92.6					75.0					92.3

listed in the order of frequency. The figures after each activity represent the number of times each was listed.

Basketball	23	Field hockey	4	Field ball	2
Soft baseball	10	Tennis	4	Speedball	2
Volleyball	9	Soccer	3	Golf	1
Football	8	Swimming	3	Hitball	1
Track and field	7	Wrestling	3	Ice hockey	1
Hard baseball	5	Boxing	2	Touchdown passball	1

A wide variety of methods employed in securing equality was listed. They are difficult of classification, but may be roughly grouped as follows:

1. Age and experience.
2. Age, height, and weight.
3. Age, height, weight, and experience.
4. Age, height, weight, and year in school.
5. Age, weight, and year in school.
6. Age and weight.
7. Height, weight, and year in school.
8. Height and weight.
9. Weight.
10. Size.
11. Ability (based on records in most cases).
12. Motor ability tests.
13. Equal strength.
14. Selection by captain.
15. Selection by coach and captain.

The following methods were listed which would hardly result in equality between teams:

By classes.
By homerooms.
Alphabetical order.
Natural grouping.
Frequent team members change.
Blind selection method—not based on individual ability.
Mixed teams.

In 40 cases for girls and 48 for boys, attempts were made to equalize teams for competition. The following shows the above in order of frequency.

Basketball	23	Hard baseball	5	Boxing	2
Soft baseball	10	Field hockey	4	Field ball	2
Volleyball	9	Tennis	4	Speedball	2
Football	8	Soccer	3	Hitball	1
Track and field events	7	Swimming	3	Ice hockey	1
		Wrestling	3	Touchdown passball	1

G. Please check (√) the activities which are pupil organized; check (√√) those which are pupil managed; and (√√√) those which are both organized and managed by pupils under supervision. (See Table IV.)

III. Program of Activities.—In order to discover the extent to which the following activities are used, please designate the approximate

amount of school time per week devoted to each, striking an average for the entire year.

In order to summarize the replies to this section of the questionnaire, it was necessary to limit the study to the variety of activities used. The approximate time devoted to each activity was given in only a limited number of cases, and consequently does not lend itself to summarization.

Table V shows the number and per cent of schools using various activities as well as the per cent of similarity between the activities of the so-called instructional program.

TABLE V

	Number of schools using activity		Per cent of schools using activity		Per cent of similarity of girls and boys activities
	Girls	Boys	Girls	Boys	
Boxing	1	18	1.7	31.0	5.5
Calisthenics	27	29	46.5	50.0	93.0
Dancing—clog and tap	35	3	60.3	5.1	8.4
Dancing—folk and national	32	3	55.2	5.1	9.2
Dancing—interpretative and natural	12	1	20.7	1.7	8.2
Dancing—social	11	6	18.9	10.3	54.5
Games—individual, couple	34	29	58.6	50.0	85.3
Games—team	41	45	70.7	77.8	90.8
Heavy apparatus	9	14	15.5	24.0	64.6
Hiking	6	4	10.3	6.9	66.9
Stunts	39	28	67.2	48.3	71.8
Swimming	10	5	17.2	8.6	50.0
Track	0	1	0.0	1.7	0.0
Winter sports	4	2	6.9	3.0	43.4
Wrestling	0	3	0.0	5.1	0.0

Total number activities 15
Total number of activities for girls 13
Total number of activities for boys 15

IV. Measurement.—Please check such of the following as are used in measuring the results of your physical education program.

Table VI indicates the number and per cent of schools using one or

TABLE VI

	Number of schools using these measures		Per cent of schools using these measures		Per cent of similarity of measures used for girls and boys
	Girls	Boys	Girls	Boys	
Annual medical examination	24	27	41.3	46.5	88.8
Annual physical examination	35	39	60.3	67.2	89.7
Skill and information tests	32	30	55.2	51.7	93.6
Physical fitness index	10	14	17.2	24.0	71.7
Strength index	4	9	6.9	15.5	44.5
Weight and height	2	2	3.0	3.0	100.0

more of these measures, and the per cent of similarity of the girls' and the boys' measurement programs.

SUMMARY

1. That so many questionnaires were answered would indicate that they were taken seriously. That the replies were honest and that judgment was used by the respondent is evidenced, in general, by the differences in averages and by individual differences scattered throughout the questionnaire.

2. With the exception of the development of muscular strength, there is a marked similarity in the statement of physical objectives of the programs for girls and for boys.

There is a very low correlation between the correction of defects and the differentiation of programs to meet individual physical and health habit needs. In fact, while many replies indicate that one of the chief objectives of the program is to improve the physical, there is but slight indication that definite efforts are used to attain this objective.

3. Initiative, self-control, honesty, courtesy, sympathy, cooperation, and loyalty as objectives for girls and boys rather closely parallel each other. Such is not the case with courage, perseverance, and justice which would appear to be much more desirable qualities to be possessed by boys than by girls.

It is a matter of surprise, as well as of concern, that so little importance is attached to the development of honesty among girls and that of sympathy for both boys and girls.

4. With the exception of an appreciation of rhythm on the part of girls, and to a comparatively slight extent on the part of boys, the cultural objectives, while they rather closely parallel each other, are not considered very important goals toward which to strive in physical education.

5. In general, eighteen different activities are used in varsity competition, the greatest emphasis for girls in order of frequency being on basketball, tennis, soft baseball, field hockey, and volleyball; and for boys basketball, football, tennis, track and field events, golf, and hard baseball. Twenty different activities are listed for girls, and twenty-two for boys. In all cases except tennis and golf, these are team game activities which will be followed by comparatively few after the completion of high school and college.

6. Thirty-five different activities—thirty for girls and twenty-six for boys—are organized on the intramural plan. A few of these in the order of frequency are: for girls, basketball, soft baseball, tennis, field hockey, track and field events, soccer, and volleyball; for boys, basketball, track and field events, soft baseball, tennis, football, hard baseball, and swimming.

With the exception of cross country and wrestling, one or more

schools offered the same sixteen activities which were most commonly listed, boxing and football each being offered to girls in one school. Among the newer innovations in the intramural program are horseback riding, golf, and archery. A significant fact is the wide variety of activities which intramural programs offer—thirty-five different ones in the fifty-eight schools under consideration.

7. Tournaments are held chiefly in basketball and tennis, with track and field events for boys and soft baseball for girls third on the list. Girls hold a greater number of tournaments, and in a wider variety.

8. Over half of the girls' and one-fourth of the boys' programs include participation in playdays or sports days.

9. It is evident from the studies made that comparatively little importance is attached to the equating of abilities among competing teams.

10. There is a surprising increase in the number and variety of activities which are pupil organized, pupil managed, or both organized and managed by pupils. The girls lead the boys in this respect.

11. A study of the activities of the regular physical education program discloses some pertinent facts,

In general, there is a marked similarity between the programs for girls and those for boys. This is especially true as concerns calisthenics, games of medium or low organization, team games, heavy apparatus, stunts and hiking. There is evidence of a differentiation of programs as to dancing, with social dancing given half as much prominence for boys as for girls. It is significant that there is a growing tendency to emphasize dancing as an important part of the senior high school girls' program. This is emphasized by the types of dancing now being used—folk and national, clog and tap, interpretative and natural, and social.

It is likewise significant that swimming, hiking, and winter and other outdoor sports are finding their way into school programs.

12. In order to determine the efficiency of the physical education program and the progress of girls and boys, it is necessary to measure results obtained from activities. The results of this study would justify the conclusion that the measures most commonly used are the medical and physical examinations, and tests variously listed as those of motor ability, skill, and achievement.

The more scientific measures of physical capacity are very little used, although these undoubtedly are the best indices of physical condition which are now available.

There seems to be little or no effort being made to devise measures of social values, or to use those now available, limited as they may be.

IMPLICATIONS

Taking into consideration statements from many of the forty-four questionnaires the contents of which because of their incompleteness are thus far not included in this study, together with the results already

presented, it becomes evident that, to a marked degree, physical education programs for girls are an imitation of those for boys.

Sound educational procedures demand that any defensible educational program should plan as scientifically and as wisely as possible for the particular individual or group concerned. To be worthy of the time and financial outlay devoted to its program, physical education should, in the first place, formulate more carefully its specific objectives. It is evident that because of the differences—particularly physical and emotional—between boys and girls, the desired outcomes of any activity's program should likewise be different.

In order to realize these objectives more fully, there is need for utilizing defensible procedures in planning and administering the program of activities more efficiently. In the case of girls, these procedures should often be quite different from those employed with boys.

There is growing evidence that a wider variety of activities is being employed in physical education programs, and that individual and couple, as well as group activities, are being employed. This is evidenced, for example, by the inclusion of tennis in many intramural programs for both girls and boys, as well as swimming for boys. However, there is need for a still greater variety of activities in most programs.

Then, too, the wide variety of activities of the intramural programs indicates a step in the right direction of differentiated programs to meet individual needs, interests, and abilities.

In the light of the social qualities desired as outcomes of physical education activities, it is unfortunate that one of the most valuable methods of attaining these goals—equating the abilities among competing teams—should be so neglected.

Possibly pupil organization and management in an increasing number of activities are responsible for the increase in the variety of activities and in the number of high school girls and boys who are participating weekly in some one or more physical education activities.

The growth of playdays and sports days points toward the inclusion of a more wholesome and desirable procedure than is usually found in varsity participation by girls.

It seems unfortunate that physical education teachers should fail to utilize their opportunities in developing an appreciation of music. Possibly this failure is due to the type of popular music often used in rhythmic work. What an opportunity to use the best music of all time, and thus to assist in engendering a love for and appreciation of the best in music—surely a desirable contribution toward the "worthy use of leisure!" A closer cooperation between the departments of music and physical education should be of mutual benefit.

Finally, it would seem that physical education should determine through a wiser measurement program than it is now employing the efficiency of its entire curriculum.

The Differential Measurement of the Speed Factor in Large Muscle Activities

By James W. Coleman
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THE PROBLEM

THIS study is an attempt (1) to determine the major factors in individual athletic performance which can be measured in terms of mass, force, and velocity, and to ascertain the relative importance of each, (2) to set up a series of tests that will predict to a high degree of accuracy the possible athletic ability of any given individual or group, and (3) to measure the individual's force, speed, and mass independently.

APPROACH

This problem was approached by determining the factors to be measured, and with due cognizance of accepted statistical procedures in handling data. The tests selected and set up were composed of elements which had definite and clear cut methods of administration, were economical of time and equipment, and which had proven to be valid, reliable, and objective.

One hundred college men were selected, ranging from freshmen to seniors, disregarding their training and experience prior to the tests that were administered in this study. The men were selected entirely on the basis of their physical fitness as shown by the physical and medical examinations given annually by the college physician and the writer. Only men that were thought to be in excellent health and physical condition were permitted to take the tests used in this study. The purpose of each test was carefully explained to the men, and only those that were keen and anxious to cooperate were selected to take part. In this way it was possible to secure men that entered the tests with the same zest as though they were their own problems. These tests were administered on a competitive basis with the hope that this method would give each man an added stimulus to do his best. The results of each test were posted where the participants could see them, and this proved to give added interest and stimulated greater effort.

Each test was thoroughly demonstrated to the participants, and they were given enough practice to have a good working knowledge of all tests given.

For convenience in administering the tests, the hundred men were divided into five groups of twenty each. Each group met as a unit three

days per week, for twelve weeks, in which time every man in each group took each test twice for the purpose of determining reliabilities.

ADMINISTRATION OF TESTS USED

The four, eight, twelve, sixteen, and twenty-four pound shots were put from a standing position in the front of the circle without the travel across the ring, with the shots held down in the palm of the hand. This method of putting was selected because it was quickly learned by the beginners, and it seemed to more nearly equalize the novice and the experienced shot putters and to minimize the factor of skill. Each man put each weight of shot three times on each of two separate days, that is, a total of six puts for each weight shot, and his best distance of the three puts on the first day was recorded as his record for that day, and his best distance of the three puts on the second day was recorded as his record for that day. In making the measurements of each put, the closest even inch was taken as the official distance.

The different weight shots were paired off in the following manner: 8 and 24, 4 and 16, 12 and 8, 16 and 12, and 24 and 4. The two different weight shots were put on the same day in the order as paired. The five groups of men were listed as group A, B, C, D, and E for the purpose of keeping the records of each group separate. This method and order caused the contestants to put the light shots first in the first round, and the heavier ones first in the second round. This system was followed to equalize things as nearly as possible for each individual and for each weight shot.

The twelve-inch playground baseball was thrown for distance from behind a line. Two parallel lines were drawn six feet apart so as to standardize the distance each thrower could use in making a short hop to aid in throwing. Standing between these two lines each individual in each of the five groups was given three throws on each of two separate days, six throws in all. The best throw of each day was recorded to the nearest foot as the record of each individual of that day.

The weight of each man was recorded on his individual data sheet along with his record in the various weight shots and the playground baseball throw.

The Iowa Revision by C. H. McCloy [1] of the Rogers Strength Index,[2] which is the sum of the unweighted strengths of the right hand grip, the left hand grip, the back lift, the leg lift, and the dipping and chinning strengths were used as a test of total strength of each individual. This total strength was recorded in pounds. The right grip, the left grip, the back lift, and the leg lift are all administered according to directions given by Rogers. The dipping and chinning strengths are scored

[1] C. H. McCloy, "A New Method Of Scoring Chinning And Dipping," RESEARCH QUARTERLY II: 4, (December, 1931.)

[2] Frederick R. Rogers, *Physical Capacity Tests,* (New York: A. S. Barnes and Company, 1931).

by methods presented by McCloy. Each individual took these tests twice, the second test being given one week after the first.

The Athletic Strength Index, by C. H. McCloy,[3] was also computed. This is the sum of the same strength tests used in the Strength Index given above, plus weight, but weighted in the following manner: one times the sum of the right and left grips, plus one-tenth of the sum of the back and leg lifts, plus two times the chinning strength, plus one times the dipping strength, minus three times the individual's weight.

The modified Sargent Jump was given, and measured by the Leap-Meter, which is a piece of apparatus fitted with an operating lever arm, from which is suspended a cap fastened by a cord. This cap is fitted to the subjects to be tested. The cord works the arm lever, which in turn moves a pencil guide holding a pencil on graph paper, and the height of the jumps is recorded in reduced size. These records can be accurately measured; one tenth of an inch equals one inch of height jumped, and can be interpolated to the nearest quarter-inch. This test consists of jumping straight upward so as to project the crown of the head as high as possible. The measurement is from the original standing height of the head under the arm lever to the highest point reached in the jump. In this test the jumpers held their belts, partially squatted, raising their heels, bending the trunk slightly forward, and pausing for a moment before jumping. They then jumped directly upward as high as possible, stretching their legs straight downward, and the head upward as far as possible without tilting the chin upward. They jumped so as to land as nearly as possible on the spot from which they jumped. The pencil line made on the graph paper was measured and multiplied by ten to find the height jumped in inches.

The Athletic Ability Rating is the writer's judgment of the athletic ability of each subject used in this problem. He knew each subject intimately, and on two separate occasions several days apart gave each subject a rating in athletic ability on the basis of five for exceptional ability, four for above average, three for average, two for below average, and one for poor athletic ability.

RELIABILITIES AND INTERCORRELATIONS OF TESTS USED

The best records made by each individual in each and all tests administered were tabulated and intercorrelated. The intercorrelations as obtained are given in Table I. The reliabilities are given in the diagonals and enclosed with parentheses.

SIMPLIFIED MULTIPLE FACTOR ANALYSIS

The next step in the analysis of these data was a simplified multiple factor analysis of the table of intercorrelations given above. The

[3] C. H. McCloy, "Norms For Tests Of Strength," Mimeograph Form, Copyrighted, 1933.

TABLE I

INTERCORRELATIONS AND RELIABILITIES

	Weight	Athletic Ability Rating	4 pound shot-put	8 pound shot-put	12 pound shot-put	16 pound shot-put	24 pound shot-put	Playground baseball throw	Strength Index	Athletic Strength Index	Sargent Jump
Weight	(1.00)	.430	.388	.542	.512	.523	.596	.229	.638	.645	.038
Athletic Ability Rating	.430	(.908)	.559	.484	.613	.620	.581	.508	.632	.613	.451
4 pound shot-put	.388	.559	(.949)	.751	.711	.783	.709	.615	.475	.488	.577
8 pound shot-put	.542	.484	.751	(.860)	.811	.848	.804	.611	.539	.587	.444
12 pound shot-put	.512	.613	.711	.811	(.951)	.911	.815	.545	.468	.509	.333
16 pound shot-put	.523	.620	.783	.846	.911	(.939)	.858	.589	.429	.501	.392
24 pound shot-put	.596	.581	.709	.806	.815	.858	(.910)	.474	.488	.483	.247
Playground Baseball Throw	.229	.508	.615	.611	.545	.589	.474	(.913)	.209	.406	.312
Strength Index	.638	.632	.475	.539	.468	.429	.488	.209	(.960)	.860	.249
Athletic Strength Index	.645	.613	.488	.587	.509	.501	.483	.406	.860	(.940)	.122
Sargent Jump	.038	.451	.577	.444	.333	.392	.247	.312	.249	.122	(.958)

method and procedure of making this analysis is clearly set forth by Thurstone.[4] In this center of gravity method of factor analysis, the "factor loadings" obtained in the first analysis do not represent the true correlations with these factors. The planes must first be "rotated." The process of rotating the planes is relatively simple, if not more than three factors are found, and this was the case in this study.

To obtain the rotations, the factors were computed in terms of angular relationships in three dimensions, and plotted on a globe in the form of unitary communalities. The factors plotted in this manner fell clearly into three dimensions, and after careful study, two points were selected through which it was apparent that one plane should fall, and a third point through which it was clear a second plane must pass. These planes were then fitted by least squares. The following table of "Rotated Factor Loadings" was obtained:

TABLE II

ROTATED FACTOR LOADINGS

	Factor I (Force)	Factor II (Speed)	Factor III (Weight)	(Hyp.^{2})*	Hyp.
Weight	.653	.010	.431	.6123	.7825
Athletic Ability Rating	.697	.376	.000	.6272	.7919
4 Pound Shot-put	.480	.770	.077	.8282	.9006
8 Pound Shot-put	.489	.641	.476	.8766	.9363
12 Pound Shot-put	.500	.611	.458	.8311	.9116
16 Pound Shot-put	.461	.703	.468	.9258	.9622
24 Pound Shot-put	.517	.521	.491	.7798	.8831
Playground Baseball Throw	.323	.556	.186	.4481	.6694
Strength Index	.936	.000	.000	.8760	.9359
Athletic Strength Index	.890	—.021	.241	.8506	.9223
Sargent Jump	.288	.577	—.326	.5221	.7226

* The square of factor I plus the square of factor II plus the square of factor III equals the square of the hypotenuse.

The above factors correspond to zero order correlations with the three factors. The next problem was that of identifying the factors. Upon careful inspection of the factor loadings, and also of the plotted factor loadings, it seemed clear that the first factor was strength or force. It will be seen that the two strength tests, as would be expected, are very high in this factor. The second factor seemed to be speed. This was taken to be the case owing to the fact that it is well known, mechanically, that in such events, power is the main element involved, and power is composed of force and velocity. It will be seen that it is most apparent, upon inspection of the table that this is consistent with the facts found therein.

[4] L. L. Thurstone, "A Simplified Multiple Factor Method and An Outline of the Computations," Copyrighted 1933, Revised in 1936, Distributed by the University of Chicago Bookstore.

The third factor is much harder to identify, but is probably weight. This is rather difficult to defend in view of the fact that weight itself gives a higher correlation with the force factor, but since this *is* a correlation, and in view of the fact we know from other studies that weight is very highly correlated with strength, this is likewise consistent with the known facts. We shall therefore, assume for the time that these factors are strength, speed, and weight, respectively, and that the factor loadings represent correlations with these factors. It should be remembered in reading the remainder of this paper that these component factors are themselves uncorrelated.

The factors that are obtained by the process of factor analysis are unrelated in much the same way that the chemical elements of a chemical compound are unrelated. For example, hydrogen and oxygen will unite to form water when used in the proper proportions, but each taken separately has no relation to the other, except the property of being able to unite. Factor analysis is a method of breaking a physical or mental action down into its elemental components. The factors in this problem, found in Table II, are related to each other only in the way that hydrogen and oxygen are, that is, these factors will unite in certain proportions to "produce" shot-putting and other activities, and they vary with each activity.

The Speed Factor here is to be taken as pure speed, and not as observed velocity, which is a function of power (velocity and force). This Speed Factor is to be taken as the large muscle contraction time as related to the activities noted.

It is interesting to note, and to call attention to the fact that the Strength Factor I in relation to the various weight shot puts and the playground baseball throw gets greater and greater to the 24 pound shot (with the exception of the 16 pound shot). The Speed Factor II gets less and less, and the Weight Factor III gets larger. This seems to be consistent with the assumptions of the identity of these factors.

A consideration of the strength tests would lead us to believe that the unweighted strength test (the one called here the Strength Index) was a better measure of general strength. This conclusion comes from the facts that, first, the communalities of the Strength Index are larger than that of the "Athletic Strength Index," and second, that the factor loading of this element is greater in the strength column (I). The Athletic Strength Index, however, correlates higher with the various shot puts, as will be seen from the table of zero order correlations (Table I).

The rating of Athletic Ability was, apparently, based first on strength and secondly on velocity, and not at all on weight.

Attention is called to the relatively small communalities of the playground baseball throw and the Sargent Jump. This is consistent with other studies in this field. There is at present no factual evidence as to

why this is so. It is possible that it may be due to the element generally known as "tieing up" in such efforts, especially in the playground baseball throw, and to differences in the technique in the Sargent Jump. In this latter event, there is a strong correlation with "motor educability" found in studies in which tests of this latter quality have been included. Since such tests were not included in this study, this element would appear only as a specific in these data. The same is probably true of the playground baseball throw.

PARTIAL AND MULTIPLE CORRELATIONS

The eight, twelve, and twenty-four pound shot-puts do not seem to offer anything of importance that is not found in the four and the sixteen pound shots. We have, therefore selected the four and sixteen pound shot-puts for further study. Therefore, further analysis of these data was made by computing partial and multiple correlations between the following variables: the strength factor loading, 4 pound shot, 16 pound shot, weight, the strength index, the velocity factor loading, and the Sargent jump, in the combinations shown below. The correlation figure is shown with each combination.

The multiple correlation of the 16 pound shot with the strength index, and weight is .536.

The multiple correlation of the strength factor loading with the 16 pound shot, and weight is .669.

The multiple correlation of the strength index with the 4 pound shot, and weight is .679.

The multiple correlation of the strength index with the 4 pound shot, 16 pound shot, and weight is .687.

The multiple correlation of the strength factor loading with the 4 pound shot, 16 pound shot, and weight is .706.

The multiple correlation of the velocity factor loading with the 4 pound shot, and the 16 pound shot is .780.

The multiple correlation of the 16 pound shot with the velocity factor loading, and weight is .804.

The multiple correlation of the 16 pound shot with the strength index, and the velocity factor loading is .824.

The multiple correlation of the 16 pound shot with the strength index, the velocity factor loading, and weight is .830.

The multiple correlation of the velocity factor loading with the Sargent jump, 4-pound shot, and weight is .847.

The multiple correlation of the velocity factor loading with the Sargent jump, the 16 pound shot, and weight is .856.

The multiple correlation of the velocity factor loading with the 4 pound shot, the 16 pound shot, and weight is .880.

It has been shown above that none of the combinations of the shots and weight gave sufficiently high correlations with the Strength Index to justify using such combinations as strength tests. It is known that

chinning strength alone correlates as high as .90 with the Strength Index [5]; hence we have not gone further with these combinations as predictors of the strength factor. This can be predicted by the Strength Index alone to a correlation of .936.

Attempts to predict the shot-put with various combinations of variables would indicate that the *velocity component* with strength and weight will do a fairly good job of predicting it (correlation .830). The velocity factor itself can be predicted to a multiple correlation of .880 by the 4 pound shot, the 16 pound shot and weight—which is the major positive contribution of this study. The strength factor being measurable to a correlation of .936, and weight, of course, being measurable to within a very high degree of accuracy, it would seem that we are now able to measure these components very satisfactorily, and that we now expect added developments along this line with further studies of these variables, and these and other factors.

For the purpose of accurately predicting this velocity factor, we have computed a regression equation. Since we wished to predict this in the form of a T-score, we placed the mean of the velocity factor at 50 and the standard deviation at 10. The resultant equation is as follows:

Velocity factor = 1.404(4 pound shot) + .116(16 pound shot)—.0813(weight) —1. This gives the velocity factor in terms of a T-score of this sample of college men.

SUMMARY AND CONCLUSION

Having analyzed the 4, 8, 12, 16, and 24 pound shots, the playground baseball throw, weight, Athletic Ability Rating, Strength Index, Athletic Strength Index and the Sargent Jump, a total of eleven events in the terms of strength, velocity, and weight as factors contributing to said events, it seems reasonable to make the two following conclusions:

1. It has been shown that the Strength Index is a very adequate measure of strength as a distinct factor in individual athletic performance.

2. We have devised a combination of the 4 pound shot, the 16 pound shot, and weight which measures the pure velocity factor to a multiple correlation of .880, and since velocity or speed as separate and distinct from force or strength is not directly measurable except, perhaps, in the physiological laboratory, this relatively accurate indirect measurement represents a contribution to measurement in this field.

[5] August H. Rump, "The Relative Contribution of Arm, Back, Abdomen, and Leg Strength to the General Athletic Ability of High School Boys," Masters Thesis, State University of Iowa, August, 1931.

A Study of the Relation of Certain Measurements of College Women to Throwing Ability

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FOR years there has been discussion as to whether the body build of an individual affects that individual's ability in various lines of athletic endeavor. One often hears the remark that one looks as if she would be able to dive, throw, run or do some other athletic event well.

The purpose of this study is to determine the degree of relationship that exists between body build, as reflected in a number of anthropometric traits, and the ability of a college woman to throw a baseball accurately or for a distance. In other words, does the body build of an individual affect her throwing ability? As a corollary to the major problem, the relation between the ability of an individual to throw accurately at a target and her ability to throw a ball a distance is determined.

PROCEDURE

Tests were made upon 477 women varying in age from 16 to 22 years inclusive. These subjects were students at the State Teachers College, Fredericksburg, Virginia, a college for women.

From each subject the following data were obtained: combined score of three distance throws, accuracy score of thirty throws at a target, age, weight, height, sitting height, chest depth, chest width, iliac width, shoulder width, length of left upper arm, length of right upper arm, length of left forearm, length of right forearm, length of left hand, length of right hand, circumference of left upper arm, circumference of right upper arm, circumference of left forearm, circumference of right forearm, and span.

The throws were made from boxes seven feet long by three feet wide. All throws were overhand throws. Men's hard baseballs were used for the distance throws. The distance score was the total number of feet scored in three trials. The accuracy throws were made with nine-inch inseam playground balls. Thirty throws, ten of which were outdoor throws and the remaining twenty indoor throws, at a wooden target placed forty feet away from the rear edge of the throwing box, were scored. Forty feet is the regulation pitching distance for women when the

nine-inch inseam playground ball is used.[1] The target used for the accuracy test was similar to that described by D. K. Brace.[2] The target was made of wood, measuring forty-four inches wide by sixty inches high. Its lower edge was six inches from the ground. The target consisted of two rectangles, the inner one, placed exactly in the center of the target, being seventeen inches wide and thirty-six inches long. This was comparable to the area for strikes in baseball, as the home plate is seventeen inches wide at its widest part,[3] and women measure about three feet from knee to shoulder. The outer rectangle was painted black and the inner one white. The target was made so that it stood in a vertical position. Balls hitting any part of the white rectangle scored two points, and balls which hit the black portion of the target scored one point. Those balls hitting on the line bordering the inner rectangle scored two points, and balls that hit the outside edge of the target scored one point.

In general the methods employed in the anthropometric measurements conformed with those outlined by Hrdlička as international standards for such measurements.[4] Those that did not conform were the measurements of the length of the upper arm and the length of the forearm. These are not mentioned by Hrdlička and the technique used was original with the investigator. In measuring the length of the upper arm the examiner stood at the side of the subject. The subject's elbow was bent at right angles and her upper arm pendent. The fixed arm of the calipers, held in the operator's left hand, was placed on the head of the humerus. The sliding arm was pressed firmly by the operator's right hand against the olecranon process. In measuring the length of the forearm, the subject's arm was again bent at right angles at the elbow. The fixed arm of the calipers, held in the experimenter's left hand when measuring the subject's left arm and in the right hand when measuring the subject's right arm, was placed against the distal end of the ulna. The movable arm was pressed by the operator's other hand firmly against the olecranon process.

Age was recorded in months, weight in kilograms, and all other measurements of the body in centimeters and tenths of centimeters. Fairbanks scales were used for weight, and standard equipment for height and sitting height. The lengths of parts of the body were measured by large wooden calipers, circumferences by a steel tape with a Gulick handle, and span by means of a horizontal paper scale placed against a wall.

Reliability of the Measures.—In order to determine the reliability of the tests or the degree to which the distinctions between individuals were true distinctions and not dependent upon the time at which the

[1] Spalding's Athletic Library, *Supplement To Official Outdoor Baseball Guide for Girls and Women*, 1933, p. 7.
[2] *Measuring Motor Ability*, p. 79.
[3] Spalding's Athletic Library, *Supplement To Official Outdoor Baseball Guide for Girls and Women*, 1933, p. 8.
[4] Ales Hrdlicka, *Anthropometry*, pp. 27–31.

tests were given, all measurements were repeated by the examiner upon a group of fifty volunteers. As will be seen by reference to Table I, all measures except the accuracy score for ten throws and iliac width had reliability coefficients above .80. Iliac width had a reliability coefficient of .7842. This lower correlation may have been due to the fact that iliac landmarks are not as prominent in some subjects as in others. In fleshy subjects the tissues must be compressed until bony resistance is met. The calipers used were not provided with a spring as was the tape that was used for measuring girths. This fact made it difficult to give the same pressure in cases where the iliac bones were not prominent as in cases where they were prominent.

As shown in Table I, the reliability of the accuracy test of ten throws which was out of doors was only .5158. In order to increase the reliability coefficient the number of throws was increased. The target was moved into the gymnasium, and the scores of the first fifty subjects who did the indoor throws were correlated with their previous scores made out of doors. Each subject made twenty indoor throws. The average reliability of the indoor throws was .7506, and the correlation, .8138, between the indoor and outdoor scores was high enough to indicate that the indoor and outdoor scores measured the same ability. The scores made outdoors and the score made indoors were, therefore, added so that each subject was scored on thirty throws. By means of the

TABLE I

RELIABILITY OF VARIOUS MEASURES
Number of subjects 50

Measure	Correlation	Probable Error
Height	.9887	.0021
Span	.9813	.0035
Weight	.9667	.0062
Sitting Height	.9618	.0071
Circumference Left Forearm	.9616	.0072
Distance (Three Throws)	.9594	.0076
Length Left Hand	.9565	.0081
Length Right Forearm	.9509	.0092
Length Left Upper Arm	.9481	.0096
Circumference Right Forearm	.9325	.0124
Chest Width	.9268	.0135
Circumference Right Upper Arm	.9267	.0135
Length Right Hand	.9266	.0135
Circumference Left Upper Arm	.9250	.0138
Length Right Upper Arm	.9241	.0139
Length Left Forearm	.9147	.0156
Accuracy (Thirty Throws)	.9003	.0181
Chest Depth	.8886	.0201
Shoulder Width	.8284	.0299
Iliac Width	.7842	.0367
Accuracy (Ten Throws)	.5158	.0700

Spearman-Brown formula the estimated reliability of increasing the number of throws from ten to thirty was found to be .9003.[5]

Objectivity of the Measures.—Two instructors in physical education in the college in which the tests were conducted called for fifty volunteers to repeat the tests that had previously been given by the investigator. Each instructor gave the tests to each of the fifty volunteer subjects. The object in having these two instructors give the tests was to show whether the tests could be scored uniformly by others with no previous training in the science of measuring. In a comparison of scores obtained by the investigator *A*, and instructor *B*, objectivity coefficients of .80 or above were obtained for all measures except accuracy score and iliac width. The accuracy score for ten throws had a correlation of only .6225, but this was increased to .7788 when thirty throws were used. Iliac width had the lowest objectivity correlation, .7731.

In a comparison of the scores obtained by *A* and instructor *C*, all but three coefficients were above .80. Chest width had a correlation of .7995 and iliac width a correlation of .7468. Accuracy for ten throws had an objectivity correlation of .6383 as compared with .6225 in the case of examiners *A* and *B*.

On the whole, therefore, the objectivity coefficients were satisfactory. Only one coefficient, iliac width, which was uniformly low, was below .75. All others, except chest width in the case of one examiner, and accuracy, were above .80, and nineteen out of forty-one, or about one-half were above .90. (For objectivity coefficients refer to Table II.)

RESULTS

Zero Order Correlations.—(Table III and Table IV.) The two factors being investigated were the distance which subjects could throw a baseball and the accuracy with which subjects could throw a baseball at a target. These two abilities were correlated in order to find whether the relation between the two was high enough to warrant the prediction of distance ability if accuracy ability is known or the prediction of accuracy ability if distance ability is known. The resulting coefficient was .7560.

In order to find to what extent the measurements of physique are related to the two factors, accuracy and distance, correlations were computed between these two measures and the body measurements. All of the zero order correlations between distance and measurements of physique were below .20. Span yielded the highest correlation, .1974, and chest width was next highest, .1906.

The correlations between accuracy throwing and measurements of physique were even lower than those between distance and the same factors. The highest correlation between accuracy and body measure-

[5] Truman L. Kelley, *Statistical Method*, p. 205.

TABLE II

OBJECTIVITY OF VARIOUS MEASURES

Number of subjects 50, except in case of accuracy, 30 throws, in which number was 48.

Measure	Correlation Examiners *A* and *B*	Probable Error	Correlation Examiners *A* and *C*	Probable Error
Height	.9821	.0030	.9526	.0088
Span	.9708	.0055	.9702	.0056
Circumference Left Forearm	.9343	.0121	.9451	.0102
Circumference Right Upper Arm	.9338	.0122	.8903	.0198
Circumference Right Forearm	.9290	.0131	.9395	.0112
Distance (Three Throws)	.9271	.0134	.9371	.0116
Circumference Left Upper Arm	.9229	.0141	.9223	.0142
Length Right Hand	.9152	.0155	.9200	.0146
Weight	.8955	.0189	.9456	.0101
Length Left Hand	.8908	.0197	.8993	.0182
Length Left Upper Arm	.8814	.0213	.8175	.0316
Length Right Upper Arm	.8766	.0221	.8304	.0296
Sitting Height	.8605	.0248	.9376	.0115
Chest Depth	.8378	.0284	.8169	.0317
Length Right Forearm	.8376	.0285	.9449	.0102
Chest Width	.8150	.0320	.7995	.0344
Length Left Forearm	.8090	.0330	.9444	.0103
Shoulder Width	.8045	.0337	.8621	.0245
Accuracy (Thirty Throws)	.7788	.0383		
Iliac Width	.7731	.0384	.7468	.0422
Accuracy (Ten Throws)	.6225	.0584	.6383	.0565

TABLE III

CORRELATIONS BETWEEN DISTANCE THROWING AND VARIOUS MEASURES OF PHYSIQUE

Number of cases 477

Measure	Correlation	Probable Error of Correlation
Span	.1974	.0297
Chest Width	.1906	.0298
Length Left Hand	.1843	.0298
Length Right Forearm	.1823	.0299
Circumference Right Forearm	.1780	.0299
Length Right Hand	.1769	.0299
Length Left Forearm	.1628	.0301
Shoulder Width	.1595	.0301
Length Left Upper Arm	.1497	.0302
Length Right Upper Arm	.1350	.0303
Circumference Left Forearm	.1336	.0303
Weight	.1307	.0304
Height	.1260	.0304
Iliac Width	.1158	.0305
Age	.1092	.0305
Sitting Height	.1008	.0306
Chest Depth	.0957	.0306
Circumference Left Upper Arm	.0892	.0306
Circumference Right Upper Arm	.0818	.0307

TABLE IV
CORRELATIONS BETWEEN ACCURACY AND VARIOUS MEASUREMENTS
Number of cases 477

Measure	Correlation	Probable Error of Correlation
Distance	.7560	.0132
Circumference Right Forearm	.1823	.0299
Span	.1692	.0300
Shoulder Width	.1686	.0300
Length Left Hand	.1529	.0302
Length Right Hand	.1517	.0302
Length Right Forearm	.1472	.0302
Chest Width	.1457	.0302
Length Left Upper Arm	.1447	.0302
Circumference Left Forearm	.1426	.0303
Length Right Upper Arm	.1404	.0303
Height	.1206	.0304
Weight	.1184	.0305
Length Left Forearm	.1167	.0305
Sitting Height	.0942	.0306
Circumference Left Upper Arm	.0752	.0307
Age	.0675	.0307
Circumference Right Upper Arm	.0670	.0307
Iliac Width	.0626	.0308
Chest Depth	.0398	.0308

ment was .1823, the relation between the circumference of the right forearm and accuracy. Span, in this instance, had the second highest correlation, .1692, with the criterion. Shoulder width placed a close third with a correlation of .1686.

Multiple Correlations.—Although individual factors may have low correlations with a criterion, they may yield a higher correlation when they are grouped In order to determine this relation the multiple correlations were computed.

As a step in the computation of the multiple correlations, zero order intercorrelations between all measurements of physique were determined. As certain factors correlated above .95 with each other they were combined and the correlations of their sums made with each of the other factors. The measurements so combined were lengths of the left and right upper arms, lengths of the left and right forearms, lengths of the left and right hands, circumferences of the left and right upper arms, circumferences of the left and right forearms.

Ezekiel states that the correlation obtained when a limited number of cases is used is not a true correlation.[6] He suggests a formula by which may be computed the true correlation that would exist if all the cases in the universe were considered. By means of Ezekiel's formula all multiple correlations were so corrected.

The multiple correlation between distance throwing and all body measurements (Table V) was .2480. This relationship was probably due

[6] Mordecai Ezekiel, *Methods of Correlation Analysis*, p. 177.

mainly to the influence of chest width and span, as the multiple correlation of these two factors with distance was .2295.

The multiple correlation (Table VI) between all body measurements and accuracy was .2005. This relationship was probably due mainly to the influence of span and the combined circumferences of left and right forearms, their multiple correlation with accuracy being .1957.

As the multiple correlations between the two criterion scores, distance and accuracy, and the measures of physique were so small, they were useless for prediction purposes.

The body measurements used in this investigation have very little association with distinctions in throwing ability. There are other factors, therefore, which account for differences in throwing ability in different subjects.

Regression Equation.—The only correlation that was high enough to warrant the formulation of a regression equation for prediction purposes was that between distance and accuracy, .7560. If a subject's accuracy score is known, her ability in distance throwing is determined by adding 90.54 to 4.66 times the accuracy score. The standard error of estimate is 46.5. This means that in 68.26 per cent of the cases the distance score will fall within 46.5 feet above or below the predicted score.

The prediction of accuracy from distance is determined by dividing the distance score by 4.66 and subtracting 19.43 from this. The standard error of estimate is 7.54.

The regression equation was applied to every ninth case in the investigation to check the formula. (Table VII and Table VIII.) In the case of accuracy prediction 67.92 per cent of the cases fell within the predicted score plus or minus the standard error of estimate, and 81.13 per cent in the case of distance.

SUMMARY

This investigation was performed for the purpose of discovering the relation between throwing ability and the following body measurements: age, weight, height, sitting height, chest depth, chest width, shoulder width, iliac width, the sum of the lengths of the left and right upper arms, the sum of the lengths of the left and right forearms, the sum of the lengths of the left and right hands, the sum of the circumferences of the left and right upper arms, the sum of the circumferences of the left and right forearms, and span. As a corollary to the major problem the relation between the ability of an individual to throw accurately at a target and her ability to throw a ball a distance was determined. The distance a subject could throw a baseball was the total of three throws with a hard ball. The subject's accuracy score was the total number of points scored in thirty throws at a target.

The zero order correlation between accuracy and distance was .7560. The probable error of the correlation was .0132. All other zero order

TABLE V

MULTIPLE CORRELATIONS BETWEEN DISTANCE AND VARIOUS MEASURES OF PHYSIQUE

Measures	Correlation	Corrected Correlation
$R_{1.3456789\,10(11-12)(13-14)(15-16)(17-18)(19-20)\,21}$	.2985	.2480
$R_{1.89(15-16)\,21}$	.2407	.2234
$R_{1.8(15-16)\,21}$	.2398	.2271
$R_{1.89\,21}$	.2390	.2262
$R_{1.8(13-14)\,21}$	.2381	.2253
$R_{1.8\,21}$	.2380	.2295
$R_{1.89(13-14)(15-16)}$	.2356	.2179
$R_{1.(15-16)\,21}$	.2237	.2146
$R_{1.(19-20)\,21}$	.2211	.2119
$R_{1.4(11-12)(15-16)\,21}$	.2148	.1950
$R_{1.89}$	.1981	.1876
$R_{1.(13-14)\,21}$	.1974	.1869

Note: Variables are indicated as follows:

1 distance
3 age
4 weight
5 height
6 sitting height
7 chest depth
8 chest width
9 shoulder width
10 iliac width

(11–12) combined lengths left and right upper arms
(13–14) combined lengths left and right forearms
(15–16) combined lengths left and right hands
(17–18) combined circumferences left and right upper arms
(19–20) combined circumferences left and right forearms
21 span

TABLE VI

MULTIPLE CORRELATIONS BETWEEN ACCURACY AND VARIOUS MEASURES OF PHYSIQUE

Measures	Correlation	Corrected Correlation
$R_{2.3456789\,10(11-12)(13-14)(15-16)(17-18)(19-20)\,21}$	.2616	.2005
$R_{2.45(11-12)(13-14)(19-20)}$	.2107	.1851
$R_{2.(19-20)\,21}$	.2053	.1957
$R_{2.89(13-14)(15-16)(19-20)}$	.2043	.1777
$R_{2.89(13-14)(15-16)}$	.1952	.1730
$R_{2.9(19-20)}$	.1918	.1815
$R_{2.9\,21}$	.1897	.1792
$R_{2.89(13-14)}$	.1880	.1711
$R_{2.4589}$	.1825	.1584
$R_{2.89}$	.1770	.1651

Note: Variables are indicated as follows:

2 accuracy
3 age
4 weight
5 height
6 sitting height
7 chest depth
8 chest width
9 shoulder width
10 iliac width

(11–12) combined lengths left and right upper arms
(13–14) combined lengths left and right forearms
(15–16) combined lengths left and right hands
(17–18) combined circumferences left and right upper arms
(19–20) combined circumferences left and right forearms
21 span

E.N.—The numbers *10* and *21* have been placed in italics to distinguish them from the single numbers 1 and 0 and 2.

TABLE VII

COMPARISON OF DISTANCE SCORES WITH PREDICTED DISTANCE SCORES

Subject Number	Distance Score (Feet)	Accuracy Score (Points)	Predicted Distance Score (Feet)	Difference Between Predicted Score and Distance Score (Feet)
324	146	12	146.46	.46
180	138	10	137.14	.86
189	152	13	151.12	.88
405	192	22	193.06	1.06
315	92	0	90.54	1.46
369	176	18	174.42	1.58
288	140	11	141.80	1.80
432	171	18	174.42	3.42
81	130	7	123.16	6.84
45	131	7	123.16	7.84
216	146	10	137.14	8.86
297	117	8	127.82	10.82
477	93	3	104.52	11.52
207	215	24	202.38	12.62
54	185	23	197.72	12.72
306	235	34	248.98	13.98
63	160	18	174.42	14.42
225	259	33	244.32	14.68
36	302	42	286.26	15.74
360	106	7	123.16	17.16
99	121	2	99.86	21.14
171	251	39	272.28	21.28
261	182	15	160.44	21.56
234	87	4	109.18	22.18
9	217	32	239.66	22.66
243	203	29	225.68	22.68
153	65	0	90.54	25.54
342	214	32	239.66	25.66
162	186	26	211.70	25.70
72	172	23	197.72	25.72
351	186	27	216.36	30.36
459	281	34	248.98	32.02
387	198	30	230.34	32.34
396	221	21	188.40	32.60
279	151	20	183.74	32.74
135	140	18	174.42	34.42
90	78	5	113.84	35.84
27	262	29	225.68	36.32
270	179	27	216.36	37.36
18	178	27	216.36	38.36
144	237	40	276.94	39.94
423	100	11	141.80	41.80
468	171	27	216.36	45.36
108	187	31	235.00	48.00
441	293	33	244.32	48.68
117	220	17	169.76	50.24
252	195	35	253.64	58.64
378	116	19	179.08	63.08
198	222	42	286.26	64.26
126	104	21	188.40	84.40
414	304	21	188.40	115.60
333	349	24	202.38	146.62
450	477	46	304.90	172.10

TABLE VIII

COMPARISON OF ACCURACY SCORES WITH PREDICTED ACCURACY SCORES

Subject Number	Accuracy Score (Points)	Distance Score (Feet)	Predicted Accuracy Score (Points)	Difference Between Predicted Score and Accuracy Score (Points)
324	12	146	11.90	.10
180	10	138	10.18	.18
189	13	152	13.19	.19
405	22	192	21.77	.23
315	0	92	-.31	.31
369	18	176	18.34	.34
288	11	140	10.61	.39
432	18	171	17.27	.73
81	7	130	8.47	1.47
45	7	131	8.68	1.68
216	10	146	11.90	1.90
297	8	117	5.68	2.32
477	3	93	-.53	2.47
54	23	185	20.27	2.73
306	34	235	31.00	3.00
63	18	160	14.90	3.10
225	33	259	36.15	3.15
36	42	302	45.38	3.38
207	24	215	27.61	3.61
360	7	106	3.32	3.68
99	2	121	6.54	4.54
171	39	251	34.43	4.57
261	15	182	19.62	4.62
234	4	87	-.76	4.76
9	32	217	27.14	4.86
243	29	203	24.13	4.87
153	0	65	-5.48	5.48
342	32	214	26.49	5.51
72	23	172	17.48	5.52
162	26	186	20.48	5.52
351	27	186	20.48	6.52
459	34	281	40.87	6.87
387	30	198	23.06	6.94
396	21	221	27.99	6.99
279	20	151	12.97	7.03
135	18	140	10.61	7.39
90	5	78	-2.69	7.69
27	29	262	36.79	7.79
270	27	179	18.98	8.02
18	27	178	18.77	8.23
144	40	237	31.43	8.57
423	11	100	2.03	8.97
468	27	171	17.27	9.73
108	31	187	20.70	10.30
441	33	293	43.45	10.45
117	17	220	27.78	10.78
252	35	195	22.41	12.59
378	19	116	5.46	13.54
198	42	222	28.21	13.79
126	21	104	2.89	18.11
414	21	304	45.81	24.81
333	24	349	55.46	31.46
450	46	477	82.93	36.93

correlations between accuracy and body measurements and between distance and body measurements were very low. The multiple correlations between accuracy and all measurements of physique and between distance and all measurements of physique were likewise very low.

Multiple correlations between the two criterion scores, distance and accuracy, and limited numbers of factors of body build were also low.

Regression equations were formulated to determine the distance score if an individual's accuracy score is known, and her accuracy score if her distance score is known. Other regression equations were not derived as the multiples were so low.

CONCLUSIONS

1. There is a very low relationship between the college woman's body measurements and her ability to throw a baseball either accurately or for a distance.

2. There is a correlation of .7560 between the college woman's ability to throw a baseball accurately and her ability to throw it a distance.

PRACTICAL APPLICATIONS

This investigation shows definitely that the physical educator is not justified in judging a college woman's ability in throwing from her physical appearance. A small woman may be able to throw a ball as far and as accurately as a large woman. However, since there is a significant relationship between ability to throw accurately at a target and ability to throw a distance, possible track and field throwers may be selected before the season begins on the basis of their ability to hit an indoor target.

The Correlation of Health Instruction

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INTRODUCTION TO THE PROBLEM

During the past decade and a half, considerable pressure has been brought to bear upon the public schools of this country to give instruction that will be productive of desirable health conduct on the part of our school population. Educators in attempting to meet this demand have found that the old traditional curriculum presents many difficulties of a varied nature in the way of establishing an ideal health instruction program. Consequently, there are many varied practices and a great variety of opinion relative to fundamental procedures existing in the health program of our schools at the present time.

According to the report of The National Survey of Secondary Education on health instruction, present practices are extremely varied as regards the amount of time devoted to health instruction, the year or years in which health instruction is given, the qualifications of the teacher, and the type of outline or syllabus used.[1] But out of the more or less chaotic condition in which health instruction finds itself at the present time in the secondary schools, definite principles and trends have developed which have received almost universal recognition. One of these is the belief that student needs and curiosities form the basis for the selection of subject matter most likely to affect conduct favorably.

During the years 1931–1932 the Ohio Department of Education made a study of student interests and needs in the secondary schools of the state.[2] Five definite approaches were made in attacking this problem. First, some twenty-three thousand questions that students of various economic, social, and age levels asked relative to health were collected in twenty-two schools; second, health problems as revealed in the physical examinations of these twenty-two schools were studied; third, a study was made of morbidity and mortality statistics in Ohio; fourth, twenty-five books were analyzed to discover what experts in the field of health think students should know about health; and fifth, ten textbooks were analyzed for health content. The results of this survey, after being organized around more than 250 teaching units,

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[1] P. Roy Brammell, "Health Work and Physical Education," United States Department of the Interior, Office of Education, Bulletin, 1932, No. 17, National Survey of Secondary Education, Monograph No. 28, Pages 29–46.

[2] D. Oberteuffer, "Health and Physical Education Series," Volume III, Department of Education, Columbus, Ohio, 1932.

formed the course of study in health education that was to be used in the junior and senior high schools of Ohio.

The schools of Logan County, however, in attempting to establish this program in their curricula met with a few obstacles, most of which were concerned with correlation. With the curriculum already overcrowded, the best that could be expected in the way of time for a special class in health instruction was one day a week. It was obvious that in the time allotted it would be entirely impossible to cover satisfactorily the material in the state syllabus. This meant that if all the health material which secondary students need and want to know about was to be taught effectively, considerable health instruction would have to be done by correlation.

The possibility of health instruction by correlation suggested many problems. How much of the material in the state syllabus could be taught by correlation? What subjects in the curriculum have contributions to make to the health education program? Is the material in these subjects properly organized for effective teaching? What material would be left for the special health class? A survey among the teachers of the county revealed that none of the teachers had a definite knowledge relative to the extent or the effectiveness with which health could be taught in the subject or subjects which he taught. Under these conditions it was felt that before a satisfactory health program could be established in the county, definite information would have to be secured regarding the opportunities for health instruction through correlation with the other subjects of the curriculum.

PURPOSE OF THIS STUDY

The purpose of this study, therefore, was to determine as far as possible to what extent and how effectively health could be taught in the junior and senior high schools of Logan County by means of correlation. By this study it was hoped that information could be secured which would enable us to set up a correlated health program which would accomplish the following ends:

1. To enable us to make use of the scientific material that each subject in the curriculum has to offer in the way of solving the health problems and curiosities of children of the secondary school.

2. To enable the health coordinator to aid the teachers by pointing out the possibilities and applications to health education that can be made in each subject.

3. To direct the teacher in the specific course in health instruction to the contributions that can reasonably be expected from other subjects.

4. To enable the teacher of the specific course in health instruction to take advantage of correlating scientific material that other subjects have to make with their own instruction rather than needlessly repeating subject matter previously taught.

5. To provide for new approaches to the same topics.

6. To provide for the repetition of important health topics in new and varied settings.

7. To interest all teachers in the health program.

METHOD OF PROCEDURE

The method of procedure used in this study was comparatively simple. In order to discover which of the health topics listed in Volume III of the Ohio Health and Physical Education Series were discussed, and to what extent, in the Logan County course of study, an analysis was made of the following material: 1. All textbooks used in the Logan County schools in the junior and senior high schools; 2. All supplementary texts used in the junior and senior high schools of Logan County.

After a complete analysis was made of each text used in the Logan County curriculum, an outline was prepared for each subject that offered opportunities for health instruction. Each outline contained many statements, each of which suggested an activity that would either partly or completely solve one or more of the health problems listed in the Health and Physical Education Series. The topics in these outlines, with the exception of the one for English Composition, were organized under the same divisions and subdivisions as the health problems were in the state syllabus. For example, health material found in any text that discussed vitamins was placed under the main division of "Eating" and the subdivision of "Foods," the same division and subdivision under which questions relative to vitamins were placed in the Ohio Health and Physical Education Series. This classification was used not only for convenience in teaching, but for convenience in referring to the state syllabus to discover what the student interests and curiosities are relative to any health topic or problem that may be taught by correlation.

TABLE I

LIST OF MAIN DIVISIONS OF VOLUME III OF THE OHIO HEALTH AND PHYSICAL EDUCATION SERIES WITH NUMBER OF SUBDIVISIONS

Main Divisions	Number of subdivisions	Main Divisions	Number of subdivisions
Playing	1	Breathing	6
Eating	6	Seeing and Hearing	2
Resting	1	Public Welfare	1
Keeping Well	15	Working	1
Thinking and Feeling	4	Heredity	1
Appearance	7	Health	1
Social Relations	2		

SUMMARY OF FINDINGS—CORRELATION BY SUBJECTS

A summary of the data collected in this investigation brings out a number of very definite facts concerning the contributions that the vari-

ous subjects in the curriculum have to make to the health education program.

General Science.—

1. Approximately one-third of the total subject matter in the general science textbooks analyzed was material applicable to health education.

2. Eight of the thirteen main topics around which the health material in Volume III of the Health and Physical Education Series of Ohio is grouped are covered by general science. In most cases most of the subtopics are treated fully, indicating that general science covers a wide range of health subject matter compared with other subjects.

3. Foods, diseases, safety, ventilation, and public welfare are the health topics most fully treated in general science.

4. In some instances the method dealing with health topics was antiquated. This was especially noticeable in the treatment of breathing where considerable emphasis was often placed upon the value of breathing exercises.

5. For effective health teaching the material in general science was often poorly arranged. This was especially noticeable in the treatment of the teeth, eyes, and ears where the structure was given first instead of last. This logical arrangement of subject matter was used almost entirely in all general science textbooks analyzed.

Biology.—

1. Approximately one-third of the total subject matter in biology is material related to health.

2. Twelve of the thirteen main topics of Table I are covered by biology. In most cases the number of subtopics discussed in biology texts is smaller than the number discussed in general science. Biology, like general science, covers a comparatively wide range of health subject matter.

3. The topics receiving greatest emphasis in biology are foods, digestion, circulation of the blood, and respiration.

4. There is considerable repetition of health material in biology that has been taught in general science. Although part of this repetition is needless, in many instances the same subject matter is approached from an entirely different viewpoint, making the repetition highly desirable.

5. Mental hygiene was but meagerly treated in the biology texts analyzed. Although considerable space is usually given to a description of the nervous system very little is given to the health interests and curiosities of the high school student relative to mental hygiene.

Physics.—

1. Between 3 and 4 per cent of the total subject matter in physics textbooks is applicable to health education.

2. Only six of the thirteen main health topics in Table I are dealt with in physics. In very few cases is any health topic treated fully.

3. Foods, ventilation, and the care of the eyes are the health topics most fully treated by physics. Even in these cases there is no tendency to organize the subject matter around health topics or to make the material applicable to the health needs of the students.

Chemistry.—

1. Approximately 8 per cent of the subject matter in the chemistry texts analyzed is related to health.

2. Six of the thirteen main topics in Table I are dealt with in chemistry. Health topics discussed in chemistry are treated more fully than they are in physics.

3. Most of the health material in chemistry is centered around the following topics: foods, cleanliness, clothing, and ventilation.

4. The chemistry class at the present time is not utilizing more than 50 per cent of its possibilities for health instruction.

Social Science.—

1. Social science texts vary greatly in the amount of material devoted to health subject matter. The average amount of material in social science textbooks dealing with health topics is 3.5 per cent with a range from 1 to 8 per cent.

2. Nine of the thirteen main topics in Table I are partly covered by social science.

3. Most of the health material in chemistry is centered around the following: recreation, public welfare, keeping well, and mental hygiene.

4. There is a growing tendency in recent social science textbooks to definitely center the material on health topics and to give far more emphasis to health topics than was previously given.

5. Problems dealing with recreation and mental hygiene are beginning to receive considerable emphasis in social science texts, especially in junior high school books.

6. The senior high school social science classes are utilizing less than 50 per cent of their possibilities for health instruction at the present time.

History.—

1. Less than 1 per cent of the total subject matter in the history textbooks analyzed was material applicable to health education.

2. Ten of the thirteen main topics in Table I are partly covered by World History. In no case are the subtopics treated fully, indicating that World History does not cover a very wide range of subject matter compared with other subjects.

3. Seven of the thirteen topics in Table I are partly covered by United States History. As is the case in World History, the subtopics are not treated fully in any instance, indicating that United States history does not cover a wide range of subject matter.

4. The health topics most fully treated in history are playing, keeping well, appearance, and public welfare.

5. History texts could devote far more space than is being done at the present time to the health needs and curiosities of the high school student.

Home Economics.—

1. Home economics textbooks vary greatly in the amount of content devoted to health material. The average in the textbooks analyzed was 75 per cent, with a range from 50 to 90 per cent.

2. As was to be expected, more space was given in home economics to health education than was given in any other subject in the curriculum.

3. Six of the thirteen topics in Table I are covered in junior high school home economics, and eight of the thirteen in senior high school home economics. In only two or three cases were the subtopics treated fully, indicating that home economics does not cover a wide range of subject matter but that it does treat very fully those topics with which it deals.

4. Between 60 and 65 per cent of the total health subject matter in home economics centers around food. Other health topics which are treated rather fully in home economics are keeping well, appearance, and public welfare.

5. The opportunity for teaching a wide range of health topics in home economics is far greater than that which is being utilized at the present time.

English Composition.—

1. English composition, although not closely related to health education, affords a good opportunity for teaching many things relative to health that each high school student should know and wants to know about.

2. At the present time, at least, we cannot expect English composition to contribute much to health education for the following reasons:

a) English has little or no connection with the study of hygiene.

b) There has been no attempt to point out to the English teacher the possibilities that composition work offers for the teaching of health.

c) Very few English teachers have the proper training to offer any health instruction or suggestions to the pupils.

English Literature.—

1. English literature, being less closely related to health education than general science, biology, or home economics, offers only a few opportunities for health instruction.

2. The range of health material that can be taught in English literature classes is not great, being limited almost entirely to the health topics related to thinking and feeling and to social relations.

3. Outside reading assignments offer an excellent opportunity for acquainting students with health knowledge that will be of value to them.

4. There is a great need of making available to the health coordinator and to the English teacher an extensive list of books dealing with health subject matter and health problems than can be used for outside reading in literature classes. No attempt has ever been made to prepare a bibliography of health books for the English teacher.

Physical Education.—

1. The physical education class offers one of the best opportunities in the high school for bringing in facts and establishing habits in respect to health.

2. The range of health material that can be taught in the physical education class is great, since situations of a varied nature are constantly arising in the physical education class that afford an excellent approach for health instruction.

3. In spite of the many advantages and opportunities that the physical education class affords for health instruction, too much reliance cannot be placed on the physical education class for much health teaching at the present time for the following reasons:

a) The amount of time allotted to physical education in the school program is comparatively small. To take additional time from the allotted time

for health instruction would do injustice to the physical education program. The students need physical education as well as health education.

b) The physical education class does not provide much opportunity for experimenting and problem solving in health education. Health instruction to be effective should make the student cognizant of the reasons back of the health behavior desired.

TABLE II

COURSES CONTAINING HEALTH MATERIAL TAUGHT IN LOGAN COUNTY AND THE PER CENT OF STUDENTS ELECTING THESE COURSES

Course	Per Cent of Students Electing This Course	Course	Per Cent of Students Electing This Course
General Science.....	100	United States History	100
Biology	95	Home Economics (Junior)	92
Chemistry	44	Home Economics (Senior)	23
Physics	53	Composition	100
Social Science (Junior)	100	English Literature	100
Social Science (Senior)	100	Physical Education ...	100
World History	100		

CORRELATION BY TOPICS

In Table III an attempt is made to show in a graphic way the extent of correlation that is possible in each subject of the curriculum. For practical purposes three divisions were arbitrarily made to indicate roughly the per cent of the total number of questions listed under each health topic in Volume III of the Ohio Health and Physical Education Series that could be answered in each subject that offers material applicable to health education. The divisions made and the symbols used to indicate each are:

0—Indicates that none of the questions listed under the health topic in Volume III could be answered by the subject matter found in the texts used in the particular course under consideration.

1—Indicates that some of the questions listed under the health topic in Volume III could be answered, but less than 90 per cent.

2—Indicates that more than 90 per cent of the questions listed under the health topic could be answered.

No serious difficulty was encountered in those instances where none of the questions listed under a particular health topic could be answered; but in those cases where part of the questions or problems listed under a health topic were discussed in the contents of the texts used in a particular course of the curriculum, it was purely a matter of personal opinion to decide what per cent of the questions could be answered. On account of the subjective opinion involved in the construction of Table III there may be a few instances where a subject was placed in the second division that should have been placed in the third division and vice

versa; but on the whole most of the subjects belong in the division indicated in the table.

English composition, English literature, and physical education were intentionally omitted from the table because so many complicating factors were involved.

TABLE III

ESTIMATED AMOUNT OF HEALTH TOPICS THAT CAN BE TAUGHT IN EACH SUBJECT

	General Science	Biology	Physics	Chemistry	Social Science	World History	U. S. History	Home Economics
PLAYING								
Physical Education	0	1	0	0	1	1	0	0
EATING								
Food	1	1	1	1	1	0	0	2
Weight-Growth	1	1	0	0	0	0	0	2
Digestion	1	1	0	1	0	0	0	1
Water	2	0	0	1	0	0	0	1
Tea and Coffee	0	0	0	0	0	0	0	1
Teeth	1	1	0	0	0	0	0	1
RESTING								
Resting	0	1	0	0	0	0	0	1
KEEPING WELL								
Professional Health Service	0	0	0	1	1	0	0	1
Common Respiratory Diseases	1	1	0	0	0	0	0	1
Communicable Diseases	1	1	0	0	1	1	0	1
Resistance to Disease	1	1	0	0	1	1	0	1
Degenerative Diseases	0	1	0	0	0	0	0	0
Circulation, Blood	1	1	0	0	0	0	0	0
Elimination	1	1	0	0	0	0	0	1
Headaches	1	0	0	0	0	0	0	0
Safety	1	1	0	1	0	0	0	2
Insects	1	1	0	0	0	0	0	2
Venereal Diseases	0	0	0	0	0	0	0	0
Sunshine	0	0	0	0	0	0	0	1
Drugs	0	0	0	0	0	0	0	0
Tobacco	1	1	0	0	0	0	0	0
Alcohol	1	1	0	1	1	0	1	0
THINKING AND FEELING								
Normal Adjustment	0	0	0	0	0	0	0	0
Personality	0	0	0	0	0	0	0	1
Emotional Control	0	0	0	0	0	0	0	0
Insanity, Feeble-mindedness	1	1	0	0	1	1	0	1
APPEARANCE								
Skin	1	1	0	0	0	0	0	1
Hair	0	0	0	0	0	0	0	1
Cleanliness-Bathing	1	1	0	0	0	1	0	1
Hands-Nails	0	1	0	0	0	0	0	2
Shoes-Clothing	1	0	0	0	1	0	0	2
Feet	1	1	0	0	0	0	0	1
Figure-Posture	1	1	1	0	0	0	0	1

TABLE III (Cont'd)

	General Science	Biology	Physics	Chemistry	Social Science	World History	U. S. History	Home Economics
SOCIAL RELATIONS								
Pre-Marriage	0	0	0	0	0	0	0	0
Education for Parenthood	0	0	0	0	0	0	0	1
BREATHING								
Ventilation	2	1	1	1	0	0	0	1
Tonsils-Adenoids	1	0	0	0	0	0	0	1
Respiration	2	2	0	0	0	0	0	1
Sinuses	0	0	0	0	0	0	0	0
Nose	1	1	0	0	0	0	0	1
Voice and Speech	1	0	1	0	0	0	0	0
SEEING AND HEARING								
Eyes	1	1	1	0	0	0	0	1
Ears	1	1	0	0	0	0	0	0
PUBLIC WELFARE								
Community Sanitation	1	1	1	1	1	1	1	1
WORKING								
Working	0	0	0	0	1	0	0	0
HEREDITY								
Heredity	1	2	0	0	1	1	0	0
HEALTH								
Meaning of Health	0	1	0	0	1	1	1	1

SUMMARY

The following conclusions, based upon the findings of this study, seem justified:

1. That of the 251 general health topics listed in Volume III of the Ohio Health and Physical Education Series, only 46 can be adequately and 117 partly taught by correlation. None of the 13 main divisions of the state syllabus is treated fully enough to be termed adequate, by any subject in the curriculum. The health topics listed under "Eating" received greater emphasis than health topics listed under any other main division, with Public Welfare, Breathing, and Appearance ranking next in the order named. The health topics listed under Thinking and Feeling, Social Relations, and Resting received the least emphasis of the main divisions in the texts analyzed for this study.

2. That approximately two-thirds of the health problems listed could not be solved from the combined material of all the subjects taught in the curriculum. Considering the fact that less than one-fifth of the total health topics are treated adequately by correlation and that in many

cases where there was opportunity for partial correlation less than 10 per cent of the topic was discussed in the textbook, this would seem to be a conservative estimate of the number of problems that could not be taught by correlation.

3. That the greatest opportunity for health correlation is found in the subjects usually taught in grades nine and ten. The reason for this is very obvious, for it is in these two grades that general science, biology, and senior high school home economics are offered. In each of these courses more than one-third of the total subject matter is material applicable to health instruction, or six times as much health material as is to be found in any of the courses offered in grades eleven and twelve. The amount of health material found in the texts used in grades seven and eight is considerable less than the amount to be found in the texts used in grades nine and ten.

4. That since the health material found in the courses offered in the upper grades of the senior high school is of a limited quantity, and since there is considerable health material that cannot be taught by correlation, grade eleven or twelve would be the logical place for curriculum builders to introduce a special class in health instruction. One reason for placing the special health class in either the eleventh or twelfth grade is the fact, as has already been pointed out, that students below the eleventh grade are securing far more health instruction through correlation than students in the upper grades of the senior high school. A second reason for placing the special health class in the late years of the high school is the fact that students with the added years of experience and training will have need of the same subject matter being treated from a different approach and with greater thoroughness.

5. That physics, chemistry, history, and English literature should be carefully analyzed for all additional possibilities for contributing to the health interests and needs of the high school student. According to this survey in each of these subjects less than 5 per cent of the total subject matter is material that is applicable to health instruction. It is felt that each of these subjects can contribute much more material than this to the health program.

6. That on account of the great number of opportunities for health instruction in many of the natural and social sciences, teacher-training institutions might with profit require prospective teachers in these fields to take some course in health education. This course, it is felt, need not be as comprehensive as the course required of the teacher of the special health class. It should not only point out the proper methods of teaching health, but it should acquaint the prospective teacher with both the curiosities and interests of the students regarding health material that can be taught in the natural and social sciences and the habits and attitudes and knowledge the students need in order to live healthfully. This training would be beneficial in two ways. It would help the teacher in seeing

the opportunities and subject matter to correlate, and it would do much to interest the classroom teacher in the correlated program.

7. That many advantages should be gained from a correlated program, wisely planned and properly administered. First, it tends to make all teachers of the school feel some responsibility for health instruction. Second, it provides for repetition in new and varied settings. The one great aim of health instruction is that of establishing habits of right living among the students. To get students to practice these desired habits it is necessary to present the same ideas many times. To do this in such a way that the teaching will not become monotonous it is necessary that new and varied approaches to the same topics be found. It is felt that correlating health with the other subjects helps to solve this problem.

8. That from this study the health coordinator should get information that can be used advantageously in the following ways:

a) It will give him information relative to the health material that can be taught in each subject of the curriculum and a knowledge of what topics should be taught in a special health class.

b) It will enable him to point out to the classroom teacher the possibilities for health instruction that exist in each subject of the curriculum.

c) It will enable him to point out to the classroom teacher the health interests and needs that students have relative to the subject this instructor is teaching, thus bridging the gap authors of textbooks often fail to bridge between the student's health interests and the health material presented in textbooks.

d) By knowing what health material each subject in the curriculum can contribute to any particular health topic it will enable him to organize many effective health projects.

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BOOK REVIEWS

HEALTH IN COLLEGES. (Proceedings of the Second National Conference on College Hygiene.) President's Committee of Fifty on College Hygiene. (New York: National Tuberculosis Association, 1937). 75c.

The purposes of this study are as follows:

1. To set forth definitely what the committee conceives to be the legal, social, and educational responsibilities of presidents and governing boards of colleges and universities to provide for the establishment and maintenance of hygiene instruction and health service.

2. To emphasize the importance of developing and maintaining good working relationships with all departments of the college.

3. To emphasize the importance of the contribution which mental hygiene has to make to the well-being of college students.

4. To show the great significance of the newer trends in the teaching of social hygiene.

5. To reveal the ways and means by which our growing understanding of the large contribution nutrition has to make to healthful living may be utilized for the benefit of the college community.

6. To urge cooperation between the physical education department and the health teaching staff, looking toward the coordination of the activity program and health habits, attitudes, and knowledges acquired in the classroom.

7. To deplore the undue emphasis upon any single phase of physical education, including intercollegiate athletics.

8. To emphasize cooperation as the keystone upon which student health in all its varied phases rests.

The problem was treated from the following viewpoints: (1) organization and correlation; (2) student health service; (3) health teaching, which included (a) objectives, (b) qualifications and preparation of teachers, (c) courses in hygiene, and (d) methods and materials; (4) special problems; and (5) relation of college hygiene to teacher training and secondary schools.

This study will be of great value to the institutions of higher education in the United States by enabling them to assist students more effectively in preparing themselves physically, mentally, and socially for healthful living, for wholesome home building and parenthood, and for wise leadership in the formation and maintenance of high standards of individual, group, and community health.

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TRACK AND FIELD ATHLETICS. George T. Bresnahan and W. W. Tuttle. (St. Louis: C. V. Mosby Company, 1937), 497 pages. $3.25.

Those interested in track and field athletics will gain a great deal from the use of this book recently published by two professors from the University of Iowa. The endeavor marks a new direction in the literature on sports techniques—one which deserves considerable note. Although coaching experience is an invaluable asset in the writing of books on techniques, we have all too frequently relied solely on this experience. This new track book is under a joint authorship consisting of a veteran coach, George Bresnahan, and a specialist in the closely allied field of physiology, W. W. Tuttle. The combined

efforts of these two men present a stability not always found in works on sports techniques.

The book is well organized and presented in a very acceptable way. Upon reading the book one is so pleased with the style and abundance of material that any criticisms that one might make seem like incidental quibbling.

In the preface the authors give as their aim, "...to place in a single volume material which is adequate for developing the beginner as well as for improving the performance of the advanced athlete." This is a difficult task to perform as much of the elementary material that is essential for the beginner proves to be boring to the advanced athlete. The dual presentation in this book, however, is done in admirable style. It makes interesting as well as instructive reading. One may question the extent of reading that will likely be done by the average athlete, but should a coach read the book carefully, he certainly will be prepared to answer most of the questions asked of him.

Preceding the technical descriptions of the various events, the authors have placed chapters on "Preliminary Season Preparations" and "Physical Aids for the Track and Field Athlete." Following the discussions on event techniques come chapters dealing with conditioning, tests for building and maintaining a track team, a review of the Iowa studies on track techniques, and a glossary of terms.

The individual events are dealt with in systematic order. They start out with comparative marks in competition which give good performances in the various events in dual, county, district, sectional, and state high school meets. This is followed by a discussion of the types of competitors and the physical qualifications of candidates, the equipment necessary, and then a discussion of the event itself. This is followed by a presentation of the common errors in performing the event and then a rather detailed daily schedule for practicing the event.

It is unfortunate that the authors have resorted to an exclusive use of drawings for illustrative purposes, particularly when they are appealing to the interests of the beginner as well as the advanced athlete. Action pictures carry with them the added stimulus of reality even when they move on to become somewhat historic. The inclusion of "Movies on Paper," however, present the best type of drawings available. They offer an excellent opportunity to analyze the details of form of those considered top-notchers in the various events. It seems as if a combination of illustrations would have enhanced the book more for general use.

One of the special features of the book is a chapter dealing with "Tests for Building and Maintaining a Team." Tests of condition, endurance, and native ability are explained in detail. There is a two-fold purpose to testing: (1) to appraise the individuals on the squad; and (2) to uncover new material. The authors justifiably emphasize the first function of testing, but it seems they have neglected the latter. Our athletic teams come from one of two sources, either from individuals who are athletes, or those who are "discovered" after arriving. With the inevitable shift away from the solicitation of athletes, at least in educational institutions, the "discovery" process will become more and more important. The educative functioning of athletics will be further completed when we confine the use of these tests to the encouragement of participation only, for it is well known that physical ability is only the smaller aspect of athletic success.

A second special feature of the book is the chapter on "Recent Advances in the Study of Track Techniques." Although the authors state that they are presenting only the work done at the University of Iowa, one is appalled at the paucity of studies beyond the ones presented. The extensive value of these studies is well known to those who have been following the experimentation and the authors have done a good job of reviewing the whole task.

A third special feature of the book is the inclusion of a glossary of terms. The glossary affords an excellent opportu-

nity to get together in our language usage. The glossary is well done and quite complete, despite the omission of such controversial terms as training and conditioning.

All in all, the book marks a distinct advance in the literature on track and field athletics.

DAN KINSEY
Oberlin College

HEALTH EDUCATION OF THE PUBLIC. W. W. Bauer and Thomas G. Hull. (Philadelphia: W. B. Saunders Company, 1937), 227 pages, 39 illustrations. $2.50.

This book "is designed for use as a practical handbook in health education . . . and a useful desk manual." The authors prepared it in response to a recognized need since no other book exactly like, nor even similar to, it has ever been made available to health educators.

Building better bodies is a task which is being given an ever-increasing amount of attention on the part of the general public. Men and women want to learn how to keep well. Other men and women, more or less well prepared to do so, are eager to tell them.

But adult health education has, so far, been carried on in a somewhat haphazard way. To be sure, such outstanding persons as Dr. Bauer, co-author of this book, have been making more people health conscious year by year. Dr. Bauer, Director of the Bureau of Health and Public Instruction of the American Medican Association, has, through the written and the spoken word, advanced greatly the cause of good health. Through his dramatized health radio programs he has gone into the homes of thousands with his enlightening messages.

Now he offers others who wish to carry on this type of work the benefit of his findings. He has blazed the trail; he has spent many years seeking out the most effective methods. He has found where the best literature may be procured, what magazines dealing with health carry valuable information, how to reach the public through the spoken and the written word.

Clear descriptions are given concerning the planning and carrying out of different types of health education programs. The use of the radio; the value of "the meeting" and how it can be used to best advantage; the possibilities offered by pamphlets, newspapers, magazines, and books for the carrying of health education material; the "miscellaneous devices" which have proved to be efficacious; all in turn are considered and discussed.

The best ways for planning a program of health education have been thoroughly tested and the results of these tests are given by the authors. "Can the results be measured?" is the challenging title of the closing chapter of this guide book.

Dr. Hull, an Associate Professor of Bacteriology at the College of Medicine, University of Illinois, and the Director of the increasingly-popular American Medical Association Scientific Exhibit, tells the reader about visual aids. A chapter on stereopticon slides is illustrated with charts, photographs, and drawings and closed with a descriptive list telling where slides may be bought or borrowed.

The value of the motion picture is fully discussed, and here, too, is submitted a lengthy list of "film sources" which the authors have "compiled from time to time."

The exhibit as a visual aid has of course been used for years for "health education." Many of us recall the traveling "medicine man" with his often startling exhibits.

But the chapter which is called "The Exhibit" in this excellent book shows how modern medical science gets its story told today in an interesting and authentic manner through this form of visual aid. Permanent exhibits, temporary exhibits, and traveling exhibits are described. Helpful hints on preparation, installation, and management under various circumstances are given. Subjects dealing with public health education are enumerated and elaborated upon.

All those interested in health education will be grateful indeed to Dr. Bauer and Dr. Hull for having put down so compactly the results of their many years spent in health education research work.

BEULAH FRANCE, R.N.

BODENKUNSTTURNEN. Dr. Wilhelm Derbolav. (Graz, Austria: Bernhard Recla, 1937.)

This book on stunts and tumbling was written by an educator who is an expert tumbler. It is a welcome contribution to physical education literature and ranks deservedly with the Cotteral sisters' latest book. In some respects it resembles their efforts; e.g., in the historical approach. In other respects it is quite different; e.g., in the development of difficult activities. Obviously, we could not expect the extreme range of difficulty included by Derbolav in a book written by women. Women can not perform the stunts men can do. At least we have never seen any.

This range of difficulty, combined with classification of activities into naturally related groups, makes the book valuable for all teachers—elementary, high school, college and club. This classification helps in memorizing the material and aids in understanding the progression in difficulty of the stunts. However, Derbolav's classification of stunts as to difficulty is rather vague. They are marked easy, medium difficult, difficult, and very difficult.

The book is divided into three main parts: fundamentals, subject matter, and teaching or practice procedures.

Considerable similarity is found in the chapter devoted to "Historical Fundamentals" and the chapter on "Historical Sketch of Tumbling" in the Cotteral sisters' book. The most ancient and important historical contributions came from Egypt, Scandinavia, Crete, Greece, and Italy. During the Middle Ages acrobatics reached great popularity in other European countries besides those mentioned. Later certain individuals became famous for the tricks they could do, much as expert athletes do today.

In the chapter devoted to "Theoretical Fundamentals," Dr. Derbolav defines acrobatics, limits its scope, and describes the nature of the various classes of activities.

The greater part of the book is devoted to subject matter, its classification and description. The procedure is comprehensive. For example, from a class of activities the author selects a group which he develops progressively from the easiest and simplest form to the most difficult and complex, and then develops its combination possibilities. All exercises are treated as individual and group activities. For the latter he uses the term "Gesellschafts Uebungen" (social exercises). The stunts are clearly described and illustrated in their progressive phases and consist of almost every type used in schools and on the stage. Some exercises are included which many would condemn as unsuitable: the stunts for suppleness, which include the split, the button (sitting with legs under the arms and the feet behind the head), and various ways of twisting shoulders and elbows. The book was evidently intended to be comprehensive in its contents and, therefore, these were included. The author does not suggest their use for school purposes.

In the third part suggestions are offered on presentation; how to develop a difficult stunt, step by step, from an easy beginning; the use of devices that may help bring results; hints for the teaching of the material to school children and the postural and physiological effects of some of the exercises.

As some principles to observe he calls attention to the fact that the physical and mental condition of the pupil determines the method of procedure; that appropriate and methodical progression is based on the pupil's experience and power of comprehension. Best results are obtained by the teacher's knowledge of the child's need and the value of activities. Thus proper selection may be made to meet this need. In addition, a knowledge of the hazards associated with each exercise and what precautions to take to avoid accidents is considered very important.

The author makes no mention of test-

ing and measuring which many among us will find strange. Likewise, he does not refer to these activities as natural gymnastics.

The book will be most interesting to those who wish to become familiar with the broad field of acrobatics, as, association teachers, college coaches, and those engaged in teacher training. It is profusely illustrated and contains a description of four hundred different tricks. The illustrations are better than those usually found in this type of book. The reader will find them very helpful. Dr. Karl Gaulhofer, who is at the head of physical education in Austria, has written an interesting "Geleitwort" for the book.

EMIL RATH
Director of Physical Education
Indianapolis Public Schools

THE COACHING OF SOCCER. Hubert E. Coyer. (Philadelphia: W. B. Saunders Co., 1937), $2.00.

The Coaching of Soccer by Hubert Coyer, Director of Athletics at State Teacher's College, Buffalo, New York, is an answer to the problems of many coaches who are confronted with the task of presenting this sport without having had much actual experience.

The early history is creditably traced by the author in his opening chapter, where he describes the "Parish Game" which started in the market place with the participants drawn up on both sides awaiting the stroke of noon when the ball was to be tossed up in the midst of them. The struggle to obtain possession of the ball was violent with the motion of the human tide heaving to and fro without the least regard to consequences. A summary of the whole situation is easily stated in the remark of the French spectator, "If an Englishman calls this playing, it would be impossible to say what he would call fighting." Having furnished this background, the author contrasts the modern game by discussing in detail the coaching of the team, offensive and defensive play, and equipment. An outstanding feature of the book is that the author stresses fundamentals which may be taught by game situations furnishing the participants the play element which is so vital in developing team work free from drudgery. Each part of the play is carefully analyzed and the prerequisites of each position are set forth in a clear and concise manner. The reader will grasp the idea immediately because the intricate situations which are so vital to successful team play are illustrated graphically.

Considerable progress has been made by the game in the schools and on the playgrounds during the past few years and it may be justly said that contributions of this nature really help to promote the sport of soccer.

ERNEST TUTTLE
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THE ADMINISTRATION OF INTRAMURAL ATHLETICS FOR MEN IN COLLEGES AND UNIVERSITIES. Carl L. Nordly. (New York: Bureau of Publications, Teachers College, Columbia University, 1937, No. 716), 94 pp.

In order to determine the status quo of intramural athletics, Nordly set out to interview twelve directors in various sections of the country. The twelve selected were chosen as representative of excellent types of programs, as well as easy of access to the interviewer. This method is considered to be the best of questionnaire methods available for research.

A comparison of the methods in the administration of intramural athletics was studied in the three following phases: place in the general setup of the entire division or department of physical or health education; personnel; the organization and promotion of the program.

General recommendations in all of the various phases of organization and administration of intramural athletics are given in two ways: first there is a survey of the pros and cons, and then Nordly determines on the basis of sound business procedure and the philosophy of education a justification for his recommendations. Other recom-

mendations "are developed from successful current policies which did not violate research findings, principles of education, or sound business and administrative procedures. Those recommended procedures, the validity of which have not been established, are offered tentatively. Further objective evidence is needed to establish their validity.

"The justification of awards and point systems for stimulating participation . . ., desirable qualifications and professional training for . . . directors, qualifications which are factors in the success of managers, techniques for judging the quality of officiating, and the development of skill tests" to classify individuals are suggestions for further study in the field of intramural athletics.

Nordly has contributed an admirable work in this field. It is well written and clearly presented for all people engaged in the several fields of physical education, with, of course, particular stress for the intramural people.

J. Edgar Caswell
Livingston Junior High School, Albany, New York

Feeding Behavior of Infants. Arnold Gesell and Frances L. Ilg. (Philadelphia: J. B. Lippincott Company, 1937), 201 pages, 200 illustrations. $4.50.

This book is an outgrowth of years spent in extensive research work and intensive record keeping.

The authors started out on the premise that "the history of civilization could almost be written around man's meals." From this platform they dived off, in company with many assistants who had excellent research backgrounds, into the turbulent waters of early infancy, there to explore the whys and the wherefores of the unhappy, undernourished baby.

Believing that "we cannot understand his feeding problems without some concept of the manner in which his feeding abilities mature," they decided to start with the infant just born into the world and follow him step by step through his early development. In this way they hoped to be able to discover how to help forestall "that kind of faulty management which creates feeding difficulties."

In order to record their findings accurately cinema pictures were taken and appear in the book along with photographic copies of the daily and weekly charts. These data were compared with a study which had previously been made of "the normal child's feeding behavior during the first six years."

But reactions to food were not observed alone. "The purpose of this survey was to chart the natural behavior of the infant in the situation of everyday living." It therefore included carefully kept records of physical and mental growth and development, the number of hours spent in sleep at various ages, the time at which elimination of body wastes was made and at what age a baby might be taught to control elimination.

The reader—professional or lay—cannot help but follow with the keenest of interest the progress of the babies described. How they first began to show interest in objects about them, gradually changed their ways of handling what was given them to hold, tried to discover the advantages offered by cups, spoons and forks, exhibited marked differences in personality development—one from the other—and seemingly changed their personality types at certain times—all this makes fascinating reading.

The fact that actual babies were used for carrying on the research work, and that actual photographs are included in the book of the babies and of the records kept makes the work a really "living" one.

A complete bibliography is offered for the help of those desiring to carry on still further research work and a very detailed index makes the finding of any subject discussed extremely easy.

Beulah France, R.N.

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